ENCYCLOPAEDIA OF
VEDIC MATHEMATICS

SHYAM PRIYA

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Vedic mathematics is based on sixteen Sutras and some sub-Sutras which provide links through mathematics: the word 'Sutra' means 'thread'. Vedic scheme is not simply a collection of rapid methods; it is a system, a unified approach, which can be swiftly learnt. Vedic Mathematics extensively exploits the properties of numbers in every practical applications, particularly in the field of computation. It makes available a whole range of methods ideally suited to these properties. After a detailed introduction to Vedic Mathematics, this book shows applications of Vertically and Crosswise from basic calculations to the evaluation of logarithms, exponentials, trigonometrical functions and the solution of simultaneous, transcendental, polynomial and differential equations. The methods given in this book are not intended to be a complete or thorough treatment of the topics they deal with. All of the ideas can probably be developed further or applied in other areas, and all can doubtless be improved upon.

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Shyam Priya

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Contents

Preface *vii*

1. **Vedic Mathematics Re-discovered** **1**
What is Vedic Mathematics? • Research and Reconstruction • Rekindled Interest in Vedic Maths • The Vedic Mathematics Sutras • Sutra: "Vertically and Crosswise' • Vedic Numerical Codified Knowledge

2. **The Mysteries of Vedic Mathematics** **29**
Mental, One-Line Calculation • Art and the Magic Squares • Sacred Mandalas, Magic Squares and Atomic Art • The Divine Proportion • Sacred Geometry • Multidimensional Geometry • Divisibility Rules

3. **Glimpses of Vedic Mathematics** **57**
Why Vedic Mathematics? • Vedic Mathematical Research • Ganita Sutras • Multi-Dimensions of Time and Space in Manasara • Higher Dimensional Reality • Organisation of Manasara

4. **Practical Application of Vedic Mathematics** **97**
Vedic Re-establishment • Re-establishment

5. **Applications of Vedic Mathematics** **109**
Greatest Common Divisor of Two Polynomials • Formal Definition • Methods for Finding the GCD • Euclidean Algorithm • Partial Fraction

6. Vedic Mathematical Sutras **125**
Historical Background • "Rules of Thumb" • Why the Vedic Math Important? • The Sixteen Sutras • Ekadhikena Purvena • Nikhilam Navatas'charamam Dasatah • Anurupyena • Urdhva Tiryagbhyam • Adyamadyena-Antyamantyena • Sankalana-Vyavakalanabhyam • Yavdunam Taavdunikritya Vargancha Yojayet • Yavadadhikam Taavadahikikritya Vargancha Yojayet • Antyayor Dasake'PI • Lopana Sthapanabhyam • Gunita Samuccayah—Samuccaya Gunitah • Veni, Vedic, Vedic • Vedic Mathematics • Textbooks and the 'Aryan' Thesis • Vedic—Mathematics

7. Application of Vedic Mathematics in Integrals **197**
Power Formula for Integration • Mental Math Methods from Asia • Vedas and Mathematics • Ancient India's Contribution to Mathematics • The Concept of Zero • Nikhilam Navatashcaramam Dashatah • Vedic Mathematics: The Ancient Indian Knowledge • Western vs. Vedic Astrology—Predictive Methodology

Bibliography 243

Index 249

Preface

Vedic Mathematics contains many examples of striking methods of calculation and there is a remarkable coherence to the system which makes it very attractive. Also the Vedic system itself suggests a kind of approach that involves going directly to the answer. Vedic mathematics is based on sixteen Sutras and some sub-Sutras which provide links through mathematics: the word 'Sutra' means 'thread'.

Vedic scheme is not simply a collection of rapid methods; it is a system, a unified approach, which can be swiftly learnt. Vedic Mathematics extensively exploits the properties of numbers in every practical applications, particularly in the field of computation. It makes available a whole range of methods ideally suited to these properties. After a detailed introduction to Vedic Mathematics, this book shows applications of Vertically and Crosswise from basic calculations to the evaluation of logarithms, exponentials, trigonometrical functions and the solution of simultaneous, transcendental, polynomial and differential equations. The methods shown are not only exceedingly efficient and new but have a unity and coherence which renders them easy to master and enjoyable to execute.

The methods given in this book are not intended to be a complete or thorough treatment of the topics they deal with. All of the ideas can probably be developed further or applied in other areas, and all can doubtless be improved upon. The mathematician will also observe a certain lack of rigor as an attempt has been made to make the material intelligible to as wide a readership as possible.

—***Shyam Priya***

Preface

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—Shyam Priya

1

Vedic Mathematics Re-discovered

Vedic Mathematics is the name given to the ancient system of mathematics which was rediscovered between 1911 and 1918 by Sri Bharati Krishna Tirthali (1884-1960).

According to his research, all of mathematics is based on 16 sutras or word formulas. For example 'Vertically and Crosswise' is one of these sutras. These formulas are compatible with the natural workings of the mind and are therefore a great help in directing the student to the appropriate method of solution.

Perhaps the most striking feature of the Vedic system is it's coherence. Instead of a hotchpotch of unrelated techniques. the whole system is beautifully interrelated and unified. The general multiplication method for example, is easily reversed to allow one- line divisions, and the simple squaring method can be reversed to give one-line square roots... and these are all easily understood. This unifying quality is very satisfying... it makes mathematics easy and enjoyable while encouraging innovation.

Difficult problems or huge sums can often be mentally solved immediately by the Vedic method. These striking and beautiful methods are just a part of a complete system of mathematics which is far more systematic than the modern "system'. Vedic mathematics manifests the coherent and unified structure of mathematics, the methods are complementary, direct and easy.

The simplicity of Vedic mathematics means that calculations can be carried out mentally (although the methods can also be written down). There are many advantages in using a flexible mental system. Pupils can invent their own methods; they are not limited to the one "correct' method. This leads to more creative, interested and intelligent students. Interest in the Vedic system is growing, mathematics teachers everywhere are looking for something better and are finding that the Vedic system really works.

Research is being carried out in many areas, including the effects on children who learn Vedic maths and the development of new, powerful but easy applications of the Vedic sutras in geometry, calculus, computing etc. But the real beauty and effectiveness of Vedic mathematics cannot be fully appreciated without actually practising the system. One can then see that it is perhaps the most refined and efficient mathematical system possible.

What is Vedic Mathematics?

The term Vedic Mathematics refers to the unique technique of Calculations based on a set of 16 sutras or aphorisms or formulae and their upa-sutras or corollaries derived from these sutras. Any mathematical problems (algebra, arithmetic, geometry or trigonometry) can be solved mentally with these sutras. Vedic Mathematics is more coherent than modern mathematics.

The sixteen sutras and their corollaries are as follows:

1. Ekadhikina Purvena -By one more than the previous one (Cor: Anurupyena)
2. Nikhilam Navatashcaramam Dashatah -All from 9 and the last from 10 (Cor: Sisyate Sesasamjnah)

3. Urdhva-Tiryagbyham-Vertically and crosswise (Cor: Adyamadyenantyamantyena)
4. Paraavartya Yojayet-Transpose and adjust (Cor: Kevalaih Saptakam Gunyat)
5. Shunyam Saamyasamuccaye-When the sum is the same, that sum is zero. (Cor: Vestanam)
6. (Anurupye) Shunyamanyat-If one is in ratio, the other is zero (Cor: Yavadunam Tavadunam)
7. Sankalana-vyavakalanabhyam-By addition and by subtraction (Cor:Yavadunam Tavadunikritya Varga Yojayet)
8. Puranapuranabyham-By the completion or non-completion (Cor: Antyayordashake)
9. Chalana-Kalanabyham-Differences and Similarities (Cor: Antyayoreva)
10. Yaavadunam-Whatever the extent of its deficiency (Cor: Samuccayagunitah)
11. Vyashtisamanstih-Part and Whole (Cor: Lopanasthapanabhyam)
12. Shesanyankena Charamena-The remainders by the last digit (Cor: Vilokanam)
13. Sopaantyadvayamantyam-The ultimate and twice the penultimate (Cor: Gunitasamuccayah Samuccayagunitah)
14. Ekanyunena Purvena-By one less than the previous one (Cor: Dhvajanka)
15. Gunitasamuchyah-The product of the sum is equal to the sum of the product (Cor: Dwandwa Yoga)
16. Gunakasamuchyah-The factors of the sum is equal to the sum of the factors

EXAMPLE 1

Ekadhikena Purvena or "By one more than the previous one".

1. Square of numbers ending in 5

$65 \times 65 = (6 \times (6+1))\ 25 = (6x7)\ 25 = 4225$

$45 \times 45 = (4 \times (4+1))\ 25 = (4x5)\ 25 = 2025$

$105 \times 105 = (10 \times (10+1)\ 25 = (10 \times 11)\ 25 = 11025$

2. When sum of the last digits is the base(10) and previous parts are the same

$44 \times 46 = (4 \times (4+1))\ (4 \times 6) = (4 \times 5)\ (4 \times 6) = 2024$

$37 \times 33 = (3 \times (3+1))\ (7 \times 3) = (3 \times 4)\ (7 \times 3) = 1221$

$11 \times 19 = (1 \times (1+1))\ (1 \times 9) = (1 \times 2)\ (1 \times 9) = 209$

3. 1 divided by 19, 29, 39,............

Consider 1/19 since 19 is not divisible by 2 or 5 it is a purely a recurring decimal take last digit 1

multiply this with 1+1 (one more) i.e. 2 (this is the key digit) $\Rightarrow$ 21

multiply 2 by 2 $\Rightarrow$ 421 multiplying 4 by 2 $\Rightarrow$ 8421

multiply 8 by 2 $\Rightarrow$ 68421 carry 1

multiply 6 by 2 = 12 + carry 1= 13 $\Rightarrow$ 368421 carry 1 continuing (till 18 digits = denominator-numerator) the result is 0.052631578947368421

4. 1/19 using divisions

divide 1 by 2, answer is 0 with remainder 1 $\Rightarrow$ .0

next 10 divided by 2 is 5 $\Rightarrow$ .05

next 5 divided by 2 is 2 remainder 1 $\Rightarrow$ 0.052

next 12 (remainder 2) divided by 2 is 6 $\Rightarrow$ 0.0526

next 6 divided by 2 is 3 $\Rightarrow$ 0.05263

next 3 divided by 2 is 1 remainder 1 $\Rightarrow$ 0.052631

next 11 divided by 2 is 5 remainder 1 $\Rightarrow$ 0.0526315 and so on...

5. 1/7 = 7/49 previous digit is 4 so multiply by 4+1 i.e. by 5

7 → 57 → 857 → 42857 → 0.142857 (stop after 7-1= 6 digits)

EXAMPLE 2

Nikhilam Navatashcaramam Dashatah or "All from nine and the last from ten"

1. 1000-457

(9-4)(9-5)(10-7) = 543

2. 1000-54 = 1000-054 = (9-0)(9-5)(10-4) = 946

Corollary: Yavdunam Jaavdunikritya Varga Yojayet or "Whatever the extent of its deficiency, lessen it still further to that very extend; and also setup the square of the deficiency."

3. Computing square of 8

power of 10 nearest to 8 is 10, so take 10 as base

8 is 2 less than 10 so 8-2 or 6 is the left side of the answer

right hand side of the answer is square of 2(deficiency) i.e., 4

so the answer is 64

similarly square of 7 is (7-3) (3x3) = 49

** if the number is greater than 10 take the surplus

square of 12 is (12+2) (2x2) = 144

square of 13 is (13+3) (3x3) = 169

EXAMPLE 3

Urdhva-tiryagbhyam or "vertically and crosswise"

1. 31 × 12

Multiply vertically on the left: 3 × 1 = 3 (first figure)

Multiply crosswise and add: (3 × 2) + (1 × 1) = 7 (middle figure)

Multiply vertically on the right 2 × 1 = 2 (last figure)

So the answer is 372

2. 275 × 513

Multiply vertically 5 × 3 = 15 write 5 and carry 1 □⇒ 5

Multiply and add crosswise last two digits

(3x7)+(1x5) = 26 + carry 1 = 27

write 7 and carry 2 ⇒ 75

Multiply and add vertically and cross wise all digits

(2x3) + (5x5) + (7x1)=38+ carry 2 = 40 write 0 and carry 4 ⇒ 075

Multiply and add crosswise first two digits

(1 x 2) + (5 x 7) = 37+ carry 4 = 41

write 1 and carry 4 ⇒ 1075

Multiply vertically 2 x 5 = 10 + carry 4 ⇒ 14

write 141075

So 275x513 = 141075

3. Divide ($12X^2$ -8X-32) by (X-2) using Urdhva-Tiryak

The quotient can be written as (12X+k)

We also know that -8x = kx - 24x Hence k = 16 cross-check -2k = -32 third term

Some Rules of Thumb

1. Multiplying a number by 11

To multiply any two digit number by 11 we just put the total of the two figures between the 2 digits.

36 × 11 = 3 (3+6) 6 = 396

74 × 11 = 7 (7+4) 4 = 7+carry 1 (1) 4 = 814

234 × 11 = 2 (2+3) (3+4) 4 = 2574

2. Diving by 9.

23/9 = 2 remainder 5

The first digit of 23 i.e., 2 is the answer and remainder is sum of 2 and 3!

134/9 = 14 remainder 8

Answer is (1st digit of 134)(1+3) remainder (1+3+4)

EXAMPLE 4

Paraavartya Yojayet or "Transpose and apply"

Divide ($12x^2$ - 8x - 32) by (x - 2), factor is +2

(X - 2)/2 $12x^2$ - 8x -32

+24x + 32

12x + 16 R = 0

Divide $7x^2$ + 5x + 3 by × - 1 Q = 7x + 12 R = 15

Divide $7x^2$ + 5x + 3 by x + 1 Q = 7x -2 R = 5

Divide $x^3 + 7x^2 + 6x + 5$ by x - 2 Q = $x^2 + 9x + 24$ R = 53

Divide $x^4 - x^3 + x^2 + 3x +5$ by $x^2 - x - 1$

Factors are x + 1

Q = $x^2 + 0x + 2$ R = 5x + 7

Divide $6x^4 + 13 x^3 + 39 x^2 + 37x + 45$ by X2 - 2x - 9

Factors 2x + 9 Q = $6x^2 + 25x + 143$ R = 548x + 1332

Divide $x^4 + x^2 + 1$ by $x^2 - x +1$ (add 0 x 3 & 0x)

$X^4 + 0x^3 + x^2 + 0x + 1$

Factors are: x - 1

Q = $x^2 + x + 1$ R = 0

Divide 1 2 3 4 by 1 1 2 Factors -1 -2 Q = 11 R = 2

Divide 1 3 4 5 6 by 1 1 2 3 Q = 12 R = - 20

The Reminder cannot be negative.

Hence Q = 11 R = 1 1 0 3

Divide 1 3 9 0 5 by 1 1 3 Q = 1 24 R = -107

Q = 123 R = 6

The following examples will help you to understand how to apply the above sutra to get partial equations in a simple and short manner.

1. $\dfrac{x^2+5x+3}{(x+2)(x-7)(x-4)}$ Eq. (1)

This can be written in the form

$\dfrac{A}{(x+2)}+\dfrac{B}{(x-7)}+\dfrac{C}{(x-4)}$ Eq. (2)

Here A , B , C are constants to be determined.

Now equate each term of the denominator to zero to get three different values of x. Now leaving out the term containing the particular value of x, substitute for x in all the other terms of the given equation to obtain respective constant for the term in the second equation.

i.e. Equating (x + 2) to zero we obtain x + 2 = 0

⇒ x = -2

Now substituting for x in the first equation by (-2) we obtain the constant A.

$$\text{Therefore A} = \frac{(-2)^2+5(-2)+3}{(-2-7)(-2-4)}=\frac{-11}{54}$$

$$\text{Similarly B} = \frac{(7)^2+5(7)+3}{(7+2)(7-4)}=\frac{52}{27}$$

Similarly $C = \dfrac{(4)^2 + 5(4) + 3}{(4-7)(4+2)} = \dfrac{31}{-18}$

The above steps can be put in the form of a few simple formulae as follows :

If the equation is of the form : $\dfrac{Lx^2 + Mx + N}{(x-a)(x-b)(x-c)}$

Then the partial fractions can be written as

$$\frac{A}{(x-a)} + \frac{B}{(x-b)} + \frac{C}{(x-c)}$$

where the constants A, B, C are given as

$$A = \frac{La^2 + Ma + N}{(a-b)(a-c)}$$

$$B = \frac{Lb^2 + Mb + N}{(b-a)(b-c)}$$

$$C = \frac{Lc^2 + Mc + N}{(c-a)(c-b)}$$

2. $\dfrac{8x^2 + 9x + 11}{(x-12)(x+13)(x+14)}$

This can be written in the form $\dfrac{A}{(x-12)} + \dfrac{B}{(x+13)} + \dfrac{C}{(x+14)}$

Using the above explained formulas we get

A = 1271/650

B = -1246/25

C = 1453/26

EXAMPLE 5

Shunyam Saamyasamuccaye or "When the samuccaya is the same, that samuccaya is zero".

This sutra is useful in solution of several special types of equations that can be solved visually. The word samuccaya has various meanings in different applicatins.

1. **It is a term which occurs as a common factor in all the terms concerned**

Thus $12x + 3x = 4x + 5x$ x is common, hence $x = 0$

Or $9(x+1) = 7(x+1)$ here $(x+1)$ is common; hence $x+1 = 0$

2. **Here Samuccaya means "the product of the independent terms"**

Thus, $(x + 7)(x + 9) = (x + 3)(x + 21)$

Here $7 \times 9 = 3 \times 21$. Therefore $x = 0$

3. **Samuccaya thirdly means the sum of the Denominators of two fractions having the same numerical numerator**

Thus, $1/(2x - 1) + 1/(3x - 1) = 0$

Hence $5x - 2 = 0$ or $x = 2/5$

4. **Here Samuccaya means combination (or TOTAL).**

If the sum of the Numerators and the sum of the Denominators be the same, then that sum = 0

$(2x + 9)/(2x + 7) = (2x + 7)/(2x + 9)$

$N1 + N2 = D1 + D2 = 2x + 9 + 2x + 7 = 0$

Hence $4x + 16 = 0$ hence $x = -4$

Note: If there is a numerical factor in the algebraic sum, that factor should be removed.

$(3x + 4)/(6x + 7) = (x + 1)/(2x + 3)$

Here $N1 + N2 = 4x + 5$; $D1 + D2$

$= 8x + 10$; $4x + 5 = 0$ $x = -5/4$

5. Here Samuccaya means TOTAL i.e. Addition & subtraction

Thus, $(3x +4)/(6x +7) = (5x +6)/(2x +3)$

Here $N1+N2 = D1 + D2 = 8x + 10 =0$ hence $x = - 5/4$

$D1 - D2 = N2 - N1 = 2x + 2 = 0$ $x = -1$

6. Here Samuccaya means TOTAL; used in Harder equations

Thus, $1/(x-7) + 1/(x-9) = 1/(x-6) + 1/(x-10)$

Vedic Sutra says, (other elements being equal), the sum-total of the denominators on LHS and the total on the RHS are the same, then the total is zero.

Here, $D1 + D2 = D3 + D4 = 2x-16 =0$ hence $x = 8$

Examples $1/(x+7) + 1/(x+9) = 1/(x+6) + 1/(x+10)$ $x = - 8$

$1/(x-7) + 1(x+9) = 1/(x+11) + 1/(x-9)$ $x = - 1$

$1/(x-8) + 1/(x-9) = 1/(x-5) + 1/(x-12)$ $x = 8-1/2$

$1/(x-b) - 1/(x-b-d) = 1/(x-c+d) - 1/(x-c)$ $x = 1/2(b+c)$

Special Types of seeming Cubics

$(x- 3)3 + (x -9)3 = 2(x -6)3$

current method is very lengthy, but Vedic method says,

$(x-3) + (x-9) = 2x - 12$

Hence $x = 6$

$(x-149)3 + (x-51)3 = 2(x-100)3$

Hence $2x-200 = 0$ & $x = 100$

$(x+a+b-c)^3 + (x+b+c-a)^3 = 2(x+b)^3$ $x = -b$

EXAMPLE 6

(Anurupye) Shunyamanyat or "If one is in ratio, the other one is zero".

This sutra is often used to solve simultaneous simple equations which may involve big numbers. But these equations in special cases can be visually solved because of a certain ratio between the coefficients. Consider the following example:

$6x + 7y = 8$

$19x + 14y = 16$

Here the ratio of coefficients of y is same as that of the constant terms.

Therefore, the "other" is zero, i.e., $x = 0$. Hence the solution of the equations is $x = 0$ and $y = 8/7$.

This sutra is easily applicable to more general cases with any number of variables. For instance

$ax + by + cz = a$

$bx + cy + az = b$

$cx + ay + bz = c$

which yields $x = 1$, $y = 0$, $z = 0$.

A corollary (upsutra) of this sutra says Sankalana-Vyavakalanaabhyam or By addition and by subtraction. It is applicable in case of simultaneous linear equations where the x- and y-coefficients are interchanged. For instance:

$45x - 23y = 113$

$23x - 45y = 91$

By addition: $68x - 68y = 204$

$\Rightarrow 68(x-y) = 204$

$\Rightarrow x - y = 3$

By subtraction: $22x + 22y = 22$

$\Rightarrow 22(x+y) = 22$

$\Rightarrow x + y = 1$

EXAMPLE 7

Yaavadunam-"Whatever the extent of its deficiency"

1. Compute 13^3

Step 1 : Consider nearest base (here 10).

Step 2 : As 13 has a excess of '3' (13 - 10 = 3), we double the excess and add the original number (13) to it, and put it on the LHS. Therefore we get 13 + 6 = 19

Step 3 : Now find the new excess. In this case it is 19-10 = 9. Now multiply this with the original excess to get the middle part of the answer. Therefore we get 9 * 3 = 27

Step 4 : Now cube the original excess and put it as the last part.

Carry over any big numbers and total to get the answer.

$$\begin{array}{r} 19\ \ 7\ \ 7 \\ 2\ \ 2\ \ \ \\ \hline 21\ \ 9\ \ 7 \end{array}$$

Therefore 13^3 = 2197

2. 47^3

As in 'Nikhilam' and Squaring, we use 'Aanurupyena' here.

1) Let the main base be 10 and the working base be 50 therefore the ratio

   x = (Main Base)/(Working Base) = 10/50 = 1/5

2) Excess is -3 (47 - 50 = -3). Double the excess and add the original number (here 47) to it.

   We get 47 - 6 = 41.

   The Base correction for this part is achieved by dividing by x^2.

   therefore we get 41/(1/25) = 41 * 25 = 1025

3) Excess in the new uncorrected number (41 - 50 = -9) is multiplied by the original excess (-3) to obtain the second part.

Therefore we get -9 * -3 = 27

The Base correction for this part is achieved by dividing by x.

therefore we get 27 * 5 = 135

4) The third part is obtained by cubing the excess.

$(-3)^3 = -27$

5) Carry over the extra numbers and total to obtain the final answer

$$\begin{array}{rrr} 1025 & 0 & 0 \\ 13 & 5 & 0 \\ & -2 & 7 \\ \hline 1038 & 2 & 3 \end{array}$$

Therefore the final answer is 103823

Sutra : Yaavadunam Taavaduunikruthya vargam cha yogayet

Meaning : "Whatever the extent of its deficiency, lessen it further to that very extent; and also set up the square of that deficiency".

This sutra is a corollary of the Nikhilam sutra.

1. Consider a simple example 92

Step 1 : Consider the nearest base (here 10).

Step 2 : As 9 has a deficiency of 1 (10 - 9 = 1), we should decrease it further by 1, and set down our LHS of the Answer as '8'.

Step 3 : On the RHS put the square of the deficiency (here 1).

we get $9^2 = 81$.

2. Consider 102

1) Base is 100

2) Deficiency is '-2' (100 - 102 = -2)

Therefore we subtract '-2' from 102

102 - (-2) = 104

This is our RHS

3) Our LHS now becomes (-2)2 which is 4

Since the base is 100 we write it as '04', so that we get 1022 = 10404

If we have multiples or sub multiples of a base, we employ the same technique as in 'Aanurupyena'. (See Nikhilam Multiplication)

3. Consider 28^2

1) Let 20 be the Working Base and 10 as the Main Base.

Therefore x = (Main Base)/(Working Base) = 10/ 20 = 1/2

2) Here the deficiency = 20 - 28 = -8

Therefore RHS = 28 - (-8) = 36

Divide by x i.e. by (1/2).

We get 36/(1/2) = 72. This is the required RHS.

3) LHS = $(-8)^2$ = 64

Since Main Base is 10, we put only '4' on the LHS and carry over '6' to the RHS

Therefore we get

282 = 72+6 | 4 == 784

Compute: 8 × 7

8 is 2 below 10 and 7 is 3 below 10.

You subtract crosswise 8-3 or 7 - 2 to get 5, the first figure of the answer.

And you multiply vertically: 2 x 3 to get 6, the last figure of the answer

The answer is 56.

Multiply 88 by 98

Both 88 and 98 are close to 100.

88 is 12 below 100 and 98 is 2 below 100

As before the 86 comes from subtracting crosswise: 88 - 2 = 86 (or 98 - 12 = 86: you can subtract either way, you will always get the same answer).

And the 24 in the answer is just 12 x 2: you multiply vertically.

So 88 × 98 = 8624

Multiply 103 × 104 = 10712

The answer is in two parts: 107 and 12, 107 is just 103 + 4 (or 104 + 3), and 12 is just 3 × 4.

EXAMPLE 8

Vyashtisamanstih- "Part and Whole"

Corollary : Lopanasthapanabhyam

It is very difficult to factorise the long quadratic $(2x^2 + 6y^2 + 3z^2 + 7xy + 11yz + 7zx)$

But "Lopana-Sthapana" removes the difficulty. Eliminate z by putting $z = 0$.

Hence the given expression $E = 2x^2 + 6y^2 + 7xy = (x+2y)(2x+3y)$

Similarly, if $y=0$, then $E = 2x^2 + 3z^2 + 7zx = (x+3z)(2x+z)$

Hence $E = (x+2y+3z)(2x+3y+z)$

Factorise $2x^2 + 2y^2 + 5xy + 2x - 5y - 12 = (x+3)(2x-4)$ and $(2y+3)(y-4)$

Hence, $E = (x+2y+3)(2x+y-4)$

EXAMPLE 9

Shesanyankena Charamena- "The remainders by the last digit"

Consider: 1/7. When divising 1(0) by 7 the remainder is 3. Therefore, dividing 3 by 7 will subsequently lead to remainder 9 (= 3x3). But since 9 is more than 7 the remainder would be 2, so the remainder sequence is:

3, 2

Now 2 divided by 7 will have remainder of 6 (3x2), that is

3, 2, 6

Continuing

3, 2, 6, 4, 5, 1

We stop when the remainder sequence starts to repeat. Now, multiply these remainders by the last digit (7) of the denominator and keep only the first digit (LSD). So we have:

7×3 = 21 ⇒ put down 1

.1

3, 2, 6, 4, 5, 1

7×2 = 14 ⇒ put down 4

.1 4

3, 2, 6, 4, 5, 1

7×6 = 42 ⇒ put down 2

.1 4 2

3, 2, 6, 4, 5, 1

Continuing

.1 4 2 8 5 7

3, 2, 6, 4, 5, 1

So the answer is 1/7 = .142857142857..........

EXAMPLE 10

Sopaantyadvayamantyam- "The ultimate and twice the penultimate"

Corollary **:** Gunitasamuccayah Samuccayagunitah—"The product of the sum of the coefficients in the factors is equal to the sum of the coefficients in the product".

Sc of the product = Product of the Sc in the factors

For example (x+7) (x+9) = (x2 + 16x + 63)

(1+7) (1+9) = (1 + 16 + 63) = 80

or (x+1) (x+2) (x+3) = (x3 + 6X2 + 11x + 6)

(1+1) (1+2) (1+3) = (1 + 6 + 11 + 6) = 24

EXAMPLE 11

Ekanyunena Purvena-"By one less than the previous one".

777 multiplied by 999 = 776,223

(776 is one less than multiplicand 777 and 223 is the compliment of 776 from 9)

120 35 79 multiplied by 999 99 99 = 120 35 78, 879 64 21

1234 5678 09 multiplied 9999 9999 99 = 1234 5678 08 8765 4321 91

The Ekanyunena sutra can be used to derive the following results:

- Kevalaih Saptakam Gunyaat, or in the case of seven the multiplicand should be 143
- Kalau Kshudasasaih, or in the case of 13 the multiplicand should be 077
- Kamse Kshaamadaaha-khalairmalaih, or in the case of 17 the multiplicand should be 05882353 (by the way, the literal meaning of this result is—"In king Kamsa's reign famine, and unhygenic conditions prevailed"—not immediately obvious what it had to do with Mathematics. These multiple meanings of these sutras were one of the reasons why some of the early translations of Vedas missed discourses on vedaangas.)

These are used to correctly identify first half of a recurring decimal number, and then applying Ekanyuna to arrive at the complete answer mechanically.

Consider for example the following visual computations:

1/7 = 143×999/999999 = 142857/999999 = 0.142857

1/13 = 077×999/999999 = 076923/999999 = 0.076923

1/17 = 05882353×99999999/9999999999999999 = 0.05882352 94117647

Note that

7×142857 = 999999

13×076923 = 999999

17×05882352 94117647 = 9999999999999999

which says that if the last digit of the denominator is 7 or 3 then the last digit of the equivalent decimal fraction is 7 or 3 respectively.

Research and Reconstruction

At the beginning of the 20th century, when there was a great interest in the Sanskrit texts in Europe, Bharati Krsna tells us some scholars ridiculed certain texts which were headed Ganita Sutraswhich means mathematics. They could find no mathematics in the translation and dismissed the texts as rubbish.

However, Bharati Krsna, who was himself a scholar of Sanskrit, mathematics, history and philosophy, studied these texts and after lengthy and careful investigation was able to reconstruct the mathematics of the Vedas. According to his research, all of mathematics is based on 16 sutras, or word formulas.

Bharati Krsna wrote 16 volumes expounding the Vedic system, but these were unaccountably lost... when the loss was confirmed in his final years, he wrote a single book...

Vedic Mathematics. It was published in 1965 five years after his death, and is still available.

"On seeingthis kind of work actually being performed by little children... the doctors, professors and other 'bigguns' of mathematics are wonder struck and exclaim: 'Is this mathematics or magic?' And we invariably answer and say: 'It is both. It is magic until you understand it, and it is mathematics thereafter" Bharati Krishna Tithaji (1884-1960)

Rekindled Interest in Vedic Maths

A copy of the book was brought to London a few years later and some English mathematicians (Kenneth Williams, Andrew Nicholas, Jeremy Pickles) tookan interest in it. They extended the introductory material given in Bharati Krsna's book and gave many courses and talks in London. A book (now out of print) Introductory Lectures on Vedic Mathematics, was published in 1981.

Between 1981 and 1987, Andrew Nicholas made four trips to India, initially to find out what else was known about Vedic mathematics. As a result of these journeys, scholars and teachers in India showed renewed interest. It seems that once they saw that some people in the West took Vedic maths seriously, they realised they had something special.

St. James's School, then in Queensgate London also other schools, began to teach the Vedic system with notable success. Today Vedic mathematics is taught widely in schools in India and a great deal of research is being done. Three further books appeared in 1984, the year of the centenary of the birth of Sri Bharati Krsna Tirthaji. These were published by The Vedic Mathematics Research Group.

The Cosmic Computer

When Maharishi Mahesh Yogi began to explain the significance and marvellous qualities of Vedic mathematics

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in 1988, Maharishi schools around the world began to teach it. At the school in Skelmersdale, Lancashire, UK, a full course, called "The Cosmic Computer', was trialled for 11-14year-old pupils. Maharishi said that the sutras of Vedic mathematics are the software for the cosmic computer which runs the entire Universe on every level and in every detail.

The Vedic Mathematics Sutras

This list of sutras is taken from the book Vedic Mathematics, which includes a full list of the 16 main sutras and 14 sub-sutras in Sanskrit, but in some cases a translation of the Sanskrit is not given in the text and comes from elsewhere. Sutra:

Translation:

By One More than the One Before
All from 9 and the Last from 10
Vertically and Cross-wise
Transpose and Apply
If the Samuccaya is the Same,it is Zero
If One is in Ratio, the Other is Zero
By Addition and by Subtraction
By the Completion or Non-completion
Differential Calculus
By the Deficiency
Specific and General
The Remainders by the last Digit
The Ultimate and Twice the Penultimate
By One less than the One Before
The Product of the Sum
All the Multipliers

144580

-Watching a child go through our education system is like watching reverse

metamorphosis: in flies a beautiful butterfly; out crawlsacater pillar".

(If You Want To Be Rich And Happy, Don't Go To School, by Robert Kiyosaki, 1992)

The gift that the Hindus gave to world, thousands of years ago, and which is currently employed in our global silicon chip technology, was none other than the invention of zero and the use of the decimal point. We call our common numbers "Arabic numerals' but, really they extend back to the Hindu concept of creation and void known as Bindu or the "Zero Point'. All Vedic mathematics is based upon the understanding of Unity consciousness, which means the utilisation of number bases that correspond to:

0, 10, 100, 1,000, 10,000 etc...all of which add to 1.

There are 16 sutras, or simple Sanskrit word formulas which solve all known mathematical problems in the branches of arithmetic, algebra, geometry and calculus. They are easy to understand, easy to apply and easy to remember.

This Vedic one-line mental arithmetic is very helpful in stimulating modern mathematicians because of its simplicity and speed. Once initiated into the Vedic rules, students of all ages tend to appreciate and enjoy the enhancement of mathematics. Vedic mathematics is a previously long-hidden treasure trove of intelligent mathematical knowledge and should be within easy reach of everyone who wishes to obtain and benefit by it.

Vedic mathematics is a total system. The Vedic mathematician was also an astronomer, an engineer, a musician a healer and a poet. The temple builder had no pen and paper; he simply calculated in his head. So, you are out in the field and you need to tile a floor that is say 98 units square. How do you do it with such mental ease? Let's look at some practical examples.

The Squaring of Numbers Near a Base

To solve 98 squared (98 x 98, or 98), we must first determine what base we are in. It is close to 100, therefore we say Base 100. We must now choose one of the 16 major sutras to solve the problem.

The one to use here is called "By the Deficiency-by whatever the deficiency, lessen it further by that much and set up the square thereof'. Sounds cryptic and meaningless, yet it quickly solves the problem. We get our answer by merely knowing how much is 100 less 98. Knowing that the deficiency is 2, we merely lessen 98 by 2 and then we tag on the squaring of that 2. As a one-line answer, the setting out would appear thus:

98 squared = 98 - 2 / 2 x 2

Simplifying it: = 96 / 4

We almost have our answer. What we need to know is that since our base is 100, it has two zeroes; therefore this fact governs the need for two spaces for two zeroes or digits after the "forward slash symbol (/). By inserting or inventing the zero as a "place marker', the answer is achieved:

98 squared = 96 / _04 = 9604

Observe similar examples:

97 squared = 97-3 / 3x3 = 94 / 09 = 9409

96 squared = 96-4 / 4x4 = 92 / 16 = 9216

When the number being squared is above the base _ of 100, here _ we add the excess and square the excess:

104 × 104 = 104 + 4 / 4 x 4 = 108 / 16 = 10,816

104 × 105 = 104 + 5 / 4 x 5 = 109 / 20 = 10,920

What if we enlarged our numbers to 998 squared? It is close to 1,000, so we say Base 1,000 and know to have three spaces (for zeroes or digits) on the right hand side of the (/).

998 squared = 998 - 2 / 2 x 2 = 996 / _ _ 4

= 996 / 004 = 996,004

Understanding this, you can be calculating digits in the millions:

9998 squared = 9998 - 2 / 2 × 2 = 9996 / _ _ _ 4

Since we are in Base 10,000, the four zeroes determine the need for four spaces (zeroes or digits) after the (/).

= 9996 / 0004 = 99,960,004

There is a worldwide debate currently raging about the efficiency of Vedic mathematics versus the crumbling foundations of Western mathematics.

Generally speaking, the theorems we all learned at school are not wrong, but clumsy. Some of the Western geometrical formulas are certainly inadequate. For example, the formulas for sphere packing in the higher dimensions increase up to the sixth dimension, then suddenly decrease for higher dimensions, which is simply absurd. Unfortunately, some die-hard senior mathematicians, in an attempt to protect the crumbling foundations that they now stand on, feel threatened by the lightning-quick mental calculations of Vedic mathematicians and go to great lengths to deride Vedic maths as a "bag of tricks'.

The Squaring of Numbers Ending in Five

Here is another example illustrating the Vedic mathematical system's utter simplicity in demonstrating "the path of least resistance'. If we want to square the number 25, i.e., 25 × 25, we would conventionally take three lines of working out. Vedic mathematics merely looks at the question, applies one of the 16 sutras, and solves it mentally in one line. In this case, the sutra at work is "By One More than the One Before', that is... the previous digit.

We observe that 25 is a two-digit number and 5 is the last digit. However we are mainly interested in "the previous digit' which is 2. Mentally we say -What is one more than two?

It is three". The word "By' in the sutra really means "to multiply'. The setting out for the first half of the answer is thus:

25 squared = 2 by 3 /.... = 2 × 3 / ....

To this we tag on the last digit "5' squared:

= 2 × 3 / 5 × 5 = 6 / 25 = 625

Similarly, all other numbers that end in 5, when squared, can be calculated instantly:

15 squared = 1 × 2 / 5 × 5 = 2 / 25 = 225

35 squared = 3 × 4 / 5 × 5 = 12 / 25 = 1,225

45 squared = 4 × 5 / 5 × 5 = 20 / 25 = 2,025

95 squared = 9 × 10/ 5 × 5 = 90 / 25 = 9,025

Sutra: "Vertically and Crosswise'

Here is another simple sutra, the one that Bharati Krsna Tirthaji refers to as most widely used, called "Vertically and Crosswise'. It solves all multiplication by application of a pattern, which is registered by the right brain as feminine-natured mathematics... in contrast to the logical, male, left-brain style of mathematics generally taught at school.

0 0 0 0 0 0

0 0 0 0 0 0

This sutra shows we will have a three-digit answer, represented by the three short horizontal lines. Here is how we traditionally write the setting out for "26 x 31'

26

× 31

Notice there are four digits involved. Let each digit be represented by a small circle or dot, as in the format shown in the diagram above. This will help you understand "cross-addition' which is shown as the middle part [(2 x 1)+(6 x 3)] and uses both multiplication and addition in the form of the letter "X', corresponding with the crossover of the optical nerve in the brain. Below, the small letter "x' stands for multiplication.

= 2 × 3 (2 × 1) + (6 × 3) 6 × 1

= 6 20 6

("2' is carried over)

= 8 0 6 = 806

Sutra: Digital Sums for Multiplication by Eleven

When computer users need to move large volumes of electronic data efficiently, the solution employed is invariably compression. "Digital Compression' (or "If the Samuccaya is the Same,it is Zero') is a powerful sutra that solves multiplication by 11 very quickly. If we want to multiply 25 by 11, we merely add the two digits of the 25 and say "2 +5', which equals 7, and insert that digit between the other two digits.

Thus the answer is 275.

Another way of showing this is to separate the two digits and insert their digital sum:

25 × 11 = 2 (2 + 5) 5

= 2 7 5

275

In this example, the "1' of the "12' gets carried over to the left:

39 × 11 = 3 (3 + 9) 9

= 3 12 9

429

Vedic Numerical Codified Knowledge

How the ancient seers sangthe longdecimal form of Pi In ancient India, they would sing songs to memorise long decimals.

The Brahmans or scholarly cast, secretive of their knowledge, sonically encrypted mathematical formulas into their devotional praises or hymns to Lord Sri Krishna and also recorded historical data in codified lyrics.

The system has similarities with numerology where values of numbers are ascribed to consonants (as in A = 1, B = 2, C = 3, D = 4)...but the Vedic numerical code was so sophisticated in Sanskrit because it possessed three layers and therefore has triple meanings.

It turns out that the decimal form of the transcendental number:

Pi = 3.14159265358979323846264338327 92....

was hidden or codified in the syllables in the following chant:

Gopi Bhagyamaduvrata - Shringishodadi Sandiga -
Kala Jeevitarava Tava - Galaddhalara Sangara

The top line, go = 3, pi= 1, bha = 4, ' ya = 1, ma = 5, duv = 9, ra = 2, ta = 6 etc., which gives the first eight figures of pi the circumference of a circle to its diameter.

Not only did the code give pi to 32 decimal places, but there was a secret Master Key within the patterning of the 32 that could unlock the next 32 decimals of pi, and so on... a ticket to infinity!

The code not only praised Krishna, it operated on another level as a dedication to Shankara. (Around AD 800. Shankara was a celebrated acharya, or teacher...who founded four monastic orders. He could read at the age of two and had mastered the Vedas by the time he was eight.

He wrote scholarly commentaries on The Bhagawad-Gita and Upanishads, which led to the decline of Buddhism in India. He is considered a partial incarnation of the avatar Shiva.

An Ancient System for the Modern Age

In conclusion, I believe the time has come for all secret knowledge of the past to be kept secret no longer.

It is time for the ancient seers' infallible mental and one-line system of Vedic Mathematics to be reintroduced.

2

The Mysteries of Vedic Mathematics

How to multiply large numbers...in your head! Find out how to accomplish rapid calculations - without a calculator. Do your children really understand the fragmented and confusing mathematical data taught to them? Would you be interested in another method that boosts confidence, increases memory skills and is presented in a fun and exciting manner?

After this course of study, you will never multiply, divide or add in the same manner that you are currently using to solve arithmetic problems. You will walk out of Jain's class confidently multiplying double digit numbers without a calculator. You do not need to know any mathematics to do this course, in fact, which has been proven many times, children who have had learning problems with the way we teach them numbers, can perform these exercises such faster than the adults in the class!

AN EXTENSIVE EXPLANATION:

Do your children really understand the fragmented and confusing mathematical data taught to them? Would you be interested in another method that boosted their confidence, increased their memory skills and is presented in a fun and exciting manner?

After this course of study, you will never multiply, divide or add in the same manner again. And no more times tables!

Jain expands and demonstrates the real ability of your mind by showing you how to complete complex mathematics... in your head!

> *"WATCHING A CHILD GO THROUGH OUR EDUCATION SYSTEM IS LIKE WATCHING REVERSE METAMORPHOSIS:*
>
> *IN FLIES A BEAUTIFUL BUTTERFLY, OUT CRAWLS A CATERPILLAR."*
>
> *"If You Want To Be Rich And Happy Don't Go To School"*

If you disliked Mathematics in your school years, do not be alarmed. It is actually a blessing as your Higher Self or Intelligence refused to embrace a system that was anything less that pure Star Language. The Brain thinks in symbols and pictures. Math must be taught laden with Shapes, Color, Aromatherapy and Music for effective Whole-Brain Learning. Most children are visual, and the ability to tap into Pattern Recognition' is the key to rapid mental calculation.

In this one day workshop you will know how to accomplish rapid calculations, mentally. No more calculators which make the brain lazy. The brain is a mental muscle and needs to be exercised. Jain predicts that if we continue to teach children with an overemphasis of using calculators in the classroom, over a 20 year period, the Global Brain will deteriorate.

An understanding of the 16 basic Sutras or "Word Formulae" solves all known mathematical problems by using an advanced and highly intelligent system of MENTAL, ONE LINE ARITHMETIC used by the Hindus 2,000 years.

Jain reveals ancient yet simple Math formulas which allow ordinary people to perform complex equations. At the same time he shows you how the world as we know it is more than we think... his teachings can for some people, bring about major shifts in the way we think about the world!

Learn also how the Hindu Invention of Zero (and the decimal system) led to modern technological advancements.

This system was reconstructed by Bharati Krsna Tirthaji (1884-1960, aka Shankarcharya of Puri) who was invited by Paramahansa Yogananda to take this knowledge, for the first time, to the western world, in 1958. The Beatles' guru: Maharishi Mahesh Yogi, who introduced Transcendental Meditation to the west, was also a student of this master and currently teaches this system in India in the spiritual Maharishi schools, whose teenage students are highly distinguished mathematical geniuses.

Some questions to ponder upon:

How could the Aryan civilization, near the Hunza Valley, 3,000 years ago, mentally compute mathematical operations that today only a calculator could achieve?

And if the maths could not be done mentally, how could they do everything we know today, IN ONE-LINE? e.g.: converting the fraction 1/19 into a decimal is an 18 digit answer that requires 35 lines of exhausting long division, how could they do it in a one simple line solution?

Why is NASA secretly using this MENTAL ONE-LINE SYSTEM OF ARITHMETIC in the field of Advanced Artificial Intelligence? and not incorporating it into our current mathematics curriculum?

Why are many of Bill Gate's Mathematicians Indians?

Is the decimal form of Pi a sonic code for dedications to Krishna?

What does the Bhagawad Gita have to say about this lost science of Clairvoyant Calculation that the ancient Temple Builders employed?

How can you become a Human Bio-Calculator?

Is the current Western Math Curriculum keeping our Children in a state of limited intelligence?

The answer to all these questions are found by understanding the ancient system of Vedic Mathematics.

If you feel like some enlightenment and want to experience Math as Art, and wish to develop your mental muscle and expand your consciousness - join us on this day for what could be one of the most exciting discoveries of your life.

The gift that the Hindus gave to world, thousands of years ago, and that which is currently responsible for a global silicon chip technology, was none other than the invention of ZERO and the use of the decimal point. We call our common numbers "Arabic Numerals" but really they extend back to the Hindu concept of creation and void known as "Bindu" or The Zero Point. In Math, it makes the magic work e.g.: if you wish to multiply 98 x 98 we need to understand Zero and Unity. All Vedic Math is based on the understanding of Unity Consciousness which means they utilize processes or Number Bases that correspond to: 0, 10, 100, 1000, 10000 etc. all of which add to 1.

There are 16 Jaw-Dropping Sutras or simple Sanskrit Word Formulae which solve all known mathematical problems in the branches of Arithmetic, Algebra, Geometry and Calculus are easy to understand, easy to apply and easy to remember.

This Vedic One-Line Mental Arithmetic is very helpful in stimulating Modern Mathematicians to adopt its simplicity and quickness. Once initiated to these Vedic rules, students of all ages will appreciate and enjoy the enhanced subject.

The aim of Vedic Mathematics is to bring this long-hidden treasure trove of intelligent mathematical knowledge within easy reach of everyone who wishes to obtain it and benefit by it. This material shakes the whole foundations of the current Western mathematics curriculum, will rewrite our current world view on Mathematics and will require a new definition of the Golden Mean: that its decimal does carry on infinitely but within its infinity there is recursive or self-similar beauty. Scientists like Marco Rodin wind toroidal coils in sync with this recursion or rhythm or pulse or pattern of 24 digits to get more output than their input! The sum of these 24 digits is 108 (108 degrees being the external angles of the pentagram and the number of beads in a rosary) which is sonically disguised as the GAYATRI MANTRA, the most famous Eastern prayer for Enlightenment.

By relying on modern electronic calculators for the next 20 years or so, without cultivating mental calculations which build the "Mental Muscle", will sadly produce a generation of young adults whose brain will have undoubtedly atrophied!

Vedic Mathematics promotes clarity and sharpness of mind as well as improving memory skills and self-confidence, by awakening the Pineal Gland (or Third Eye) to clairvoyantly "see" or intuitively know the predicted answer. Mystics say that the Pineal gland, located in the exact centre of the brain, was once the size of large cherry, but now it is the size of a pea. Two reasons are that we drink denatured defunct water and we no longer build the Mental Muscle, over-relying on calculators etc. to solve simple problems. The brain is a muscle, being 90% water, it needs to be hydrated with pure alive waters and regularly exercised.

> *"This Cosmic Manager, the Cosmic Mathematician is eternally free from mistakes. The Cosmic Mathematician is present within everyone, it is the light of life of everyone; it is present within everyone in the structure of Rigveda and the Vedic Literature; it is the light of pure intelligence." (Maharishi Mahesh Yogi)*

Mental, One-Line Calculation

The Indians have an ancient system of Clairvoyant Mathematics claiming that they can literally "see" the "shape" of the Answer to any Problem, like 106 x 108. The highest Sutra or Formula of all the 16 possible Sutras, is called "Vilokanam" which means, "By mere Intuition" or "By Mere Observation". Just by looking at the Question: What is 106 × 108" they can see the answer within one second. In some cases, the answer is not resolved mentally, so it must be written down, but only by using one line of working out. So these Yogis, 2,000 years ago, had intellectual contests or spiritual games of outwitting one another with mathematical "Shortcuts". It was the spiritual head of India: Bharati Krsna Tirthaji, (1884-1960) who reconstructed all the knowledge from the time of Buddha circa BC500 and evolved it into Mental, One-Line Arithmetic that we are just catching onto today.

So to solve 106 × 108, think of the Base 100 and consider only how much these 2 numbers are above the Base of 100. As soon as I mentally flag those two excesses of 6 and 8, I have my answer instantly, by adding the 6 to the other number 108, making it 108 + 6, and by multiplying those two deficiencies which is 6 x 8, and viola, there is the magical, instant, mental answer:

106 × 108 = 108 + 6 / 6 × 8 = 114 / 48 =11,448.

Vedic Philosophy

According to the spiritual head of India, Bharati Krsna Tirthaji (1884-1960) the "Vedas" are "the illimitable storehouse of all Knowledge". This meant that you had to become accomplished in many fields of Knowledge. There was no such thing as just a Vedic Mathematician, you also had to study the Vedas of the Stars and Astronomy, you had to know the AyurVeda (Ayur means "Life") which is knowledge of Medicine and Healing; and the Vedas of Music, and Engineering and the Art of Cooking etc. Knowledge of the Vedas evolved you into a Total Being.

Some scholars believe that when Atlantis fell, when the Oceans rose only the mountain-top dwellers survived and those that arrived to the Himalayan (and Andes) areas were known as the Aryan Race and with them they brought the gifts of the Vedas.

Vedic Mathematics

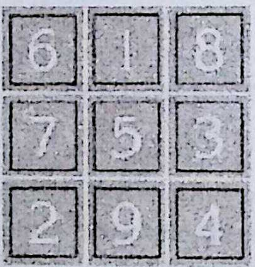
This is a "Mental, One-Line System of Arithmetic" based on 16 Universal Sutras or Formulas or Shapes that solve all known mathematical problems. Developed over 3,000 years ago, originating with the Zero concept and the Decimal System, it has become a highly intelligent and sophisticated system of mathematical Short Cuts. E.g.: To find the reciprocal of 19, in decimal form, the high-school student is required to labour with 35 lines of working out going down the page, and is bound to make a mistake, as you are required to know your 19 Times table; whereas in India today, a teenage student can accomplish this 18 digit solution in one swift, horizontal and elegant line of arithmetic, in one line, whereas, today, we need a computer to divide 1 by 19. Vedic Mathematics therefore encodes the Law of Efficiency, the Path of Least Resistance. Traditional Mathematics is not wrong, it is only clumsy. The Indians claimed that they invented the Zero and gave us the decimal, not the Arabs whose books falsely claim they invented it; but research now indicates that the Babylonians, 12,000 years ago used The Zero to build their stepped pyramids known as 'ziggurats'.

> *"Vedic Mathematics is that one field of knowledge which fulfills the purpose of education by developing the total creative genius of the individual, giving him / her the ability to be always spontaneously right and automatically precise so that his / her action, supported by Natural Law, is always effortlessly fulfilling".*

Art and the Magic Squares

There is a treasure house of knowledge encoded within these harmonic matrixes that the ancients knew and hid. Magic Squares for thousands of years have fascinated many cultures and many great minds like Benjamin Franklin and Albrecht Durer. The ancient mystery schools adored their richness of symbolism. The 3x3 square is known as the Lo Shu in Tibetan and Taoist Calendars and Cosmology. The ancient Indian seers referred to as a Space Matrix or Code that governed the sacred architecture of their Temple's. In effect, the Lo-Shu is the simplest blueprint that unifies all complex Life components. Not only is it linked to the workings of the D.N.A molecule but it is part of our Ascension Process.

- Learn how to transform numbers into Art.
- Understanding Higher Knowledge through the Language of Shape.
- Learn the patterned language of our Universe!
- Learn Ancient symbols of Order amidst Chaos.



6	1	8
7	5	3
2	9	4

Magic Squares are ancient boxes of numbers whose sums of rows, columns and diagonals all add up to the same sum. This matrix represents Perfect Equality in all directions or dimensions. Elegant or aesthetically pleasing patterns can be created when a long, continuous line is joined in arithmetical order from 1 to 2 to 3 to 4 etc. to the last number. This is how Mathematics is transformed into Art. This line connecting such consecutive or sequential numbers is the backdoor into the world of Atomic Art or Nuclear

Geometry, arriving at scientifically verified atomic structures. Order is created out of Chaos.

The Latin axiom: e pluribus, unum, applies in Feng Shui and Magic Squares, meaning: Out of the Many, the One. Each individual part or cell of any system, whether it be crystal or human must be honored in respect to the Greater Whole, in all Time, in all Space unconditionally.

The ancient Magic Square of 3 × 3 (also known as the "Lo-Shu" in ancient China, C17th BC) is also the centre of the Tibetan Calendar/Cosmology. It is a timeless mathematical harmonic whose sums of the columns, rows and diagonals all add up to and vibrate to 15. Symbolically the Magic Square creates Order amidst Chaos, and Equality in All Dimensions.

One definition of Feng Shui details the aesthetic placement of objects; this is similar to the divine order of the placement of numbers in a magic square. Notice that all the pairs around the centre of the magic square of 3x3 have a sum of double the central cell. That is, 1 and 9 =10, 2 and 8 =10, 3 and 7 =10, 4 and 6 =10.

Ancient Card Puzzle: There are 9 playing cards in front of you.

1, 2, 3, 4, 5, 6, 7, 8, 9

How can you align them so that the 3 vertical columns, the 3 horizontal rows and the 2 diagonals all add up to the same number?

The solution below is one of 8 possible arrangements:

6 1 8

7 5 3

2 9 4

The oldest known record in print is from China, 5,000 years, known as The Lo-Shu and is the emblem or badge for the Feng Shui community who seek harmony in the placement of things.

Symbolic of searching for Order amidst the Chaos, draw a long and continuous line from 1, to 2 to 3 , etc., to the last number 9, in sequential or consecutive or natural counting order. A specific Yantra or Pattern is created. This mere act of Transforming Numbers into Art has subtly shifted you from the logical Left Brain realm of Numbers to the creative, picturesque Right Brain realm. This simple activity has created fusion of the left and right brain, now called Whole-Brain Learning.

It transpires, upon further superimposition of the same pattern upon itself, at various angles like 90 and 45 degrees etc. that the patterns begin to resemble specific Atomic Structures of Rutile, and Platinum Crystal, and Beryllium etc. . For this reason, a new realm of knowledge has emerged known as Atomic Art. What this does is to put side by side the Scientist's Tunneling Microscope diagrams alongside the Mystic's Yantras or Magic Square diagrams and conclude without doubt that they are identical. Importantly, this bridges the Physics with the Metaphysics, and East with West. This places Mathematics as a strong candidate for the worlds' evolution towards a Universal Language, all through the hidden secrets of the humble Magic Square.

Magic Squares have appeared in old Essene Bibles, where Jesus apparently referred to the Divine Kingdom in terms of the Magic Square of 7 × 7, where The Above is the same as The Below, where The Left is the same as The Right, where everyone is equal, for if you were to take out only one number, the magic square would become disharmonic. In this sense, it is a symbol of community, of society, where we need the baker, the plumber, the nurse and encouraged to develop a sense of Gratitude for the underlying structural Unity of all Life. The Magic Square therefore defines perfect Equality in all aspects, in all Dimensions, "e pluribus unum" meaning, "Out of the Many, the One.

There is a treasure house of knowledge encoded within this harmonic matrix that the ancients knew and hid. Magic Squares for thousands of years have fascinated many cultures and many great minds like Benjamin Franklin and Albrecht Durer.

Many sacred symbols emerge when the original Magic Square Pattern or Yantram (singular of Yantra which is the plural) is rotated upon itself. Like snowflakes, millions of Magic Squares can be created. There are 8 permutations of the primal 3x3 Magic Square known also as The Lo-Shu from China 4,000 years ago. There are 880 permutations of the 4x4 Magic Square, but as we get to the 5x5s and 6x6s there are millions! Mathematics is a Universal Language. That means that it will always exist, without decay or corruption.

As Pythagorus said, in the 6th century BC, "NUMBER IS THE BOND OF ALL THINGS".

— Why was it at the centre of the Tibetan Calendar/ Cosmology (Time Code / Applications in Time Travel)?

— Why did Ambaji, of the Hindu pantheon, the ancient goddesses of Creation (the universe flows through her breast), have as her tantric symbol, this Magic Square of 3x3, which has 8 possible permutations?

— And which Buddha, in his enlightenment, described in detail the 8 sided nature of subatomic molecules: the "Acta-Kalapos". Durga and Kali and Shakti etc. have variations of the same.

— Why is it that when you translate NUMBERS INTO ART, by drawing a long connecting line, from 1 to 2 to 3 etc. to the last number, that elegant and phi-ratioed patterns appear? That when tiled or tessellated, produce the atomic structure of Diamond (which is verified by the clairvoyant drawings of the Occult Chemists: Charles Leadbeater and Annie Besant.

- Why is it that the pattern for the Magic Square of 11x11 is almost identical to the Ley Line Grid developed by Bruce Cathy, a New Zealand pilot, which was originally the jig-saw-puzzle-map of UFO sightings in his area?
- Why did Professor Searl, of the UK, have his work on levity discs and over-unity generators banned? The metals of his generators for the spacecraft he built were intimately related, by proportion, to the atomic table of elements and to the opposing pairs of the above Magic Square of 3×3, e.g.,: notice that all pairs around the central cell have a sum of 10, thus 2 parts gold was alloyed with 8 parts silver, or 3 parts titanium to 7 parts nickel.
- Why did King Solomon the Rabbi, design his Seal based on the 3 rows of the above Magic Square being translated into a Natural Square of 3 (that has its numbers in Counting Order)?

In this day lesson, you will superimpose a Magic Square of 7×7, by rotation of 90 degrees upon itself, to reveal ancient symbols at its centre: the Hindu Peace Symbol of the Swaztika nesting within the Christian Cross! The ancient Essenes adored the richness of symbolism within these Mystic Squares and gave accounts or Parables of Jesus (Isa or Iesu) that related to our sense of community symbolized by the magic square, that each person, so positioned, has a divine role to play, that if one number was taken away or moved, it would no longer be magical, to realize 'Order amidst the Chaos', and the ancient axiom:

"As Above.. so below"

Sacred Mandalas, Magic Squares and Atomic Art

"Mandal" is the "world", as you know from other languages like in French: le Monde. Most mandalas have a geometric centre, the Source of Creation, and from this radiates all Life. Eastern teachers state that the Mandala is really a 3-Dimensional object descriptive of the World, and what westerners call 'mandala' is really a Yantra. A Yantra is the 2-Dimensional view, or the shadow of the Mandala. A Yantra is the Artwork, the Power-Lines, the Black and the White of the 3D Mandala. Yantra's psychoactive lines conducts psychic essences infused by Yogi or designer or artist in a sacred space, so the goal of the simple Yantra is to make the complex and Invisible Mandala, visible. Thus the Yantra of the Triangle is really the Mandala of the Tetrahedron, and the Circle is the Sphere. By understanding this concept, this connection of 2D to 3D, the neophyte can tap into the 4D, and the 5-Dimensional realities, to ultimately conclude that there is no separation, no dimensions, only Oneness as symbolize by the Mandala.

A Yantra is charged by one's thoughts and intentions. That is why yogis and yoginis construct them on the full-moon, whilst fasting or celibate, and create the actual diagram in datura juice, at specific times of the day and year determined by astrological highlights. Its sacred in the sense that all your energies are focused on just that activity of Yantra Creation, as all Manifestation arises through pure thought.

The Divine Proportion

Discover the GOLDEN MEAN SPIRAL, the nature of ALL of creation, the fabric of LIFE itself! Nested within your Heart is the sacred geometry golden mean ratio, it is the centre of a greater Galactic Grid connecting us to all Memory of the Universe and all Atomic Levels. Embrace part of the ascension process already morphologically and geometrically encoded into our bio-magnetic and bio-electrical fields.

— Learn how to recognize this proportion in your body, in nature, in Art and Architecture and in Universal forces.

— Discover why this knowledge is important to survival after death and plays a central role in immortality.

The Divine Proportion:

~ *your map ~ your DNA ~ your universe*

Learn why the shape of the Pine Cone is optically similar to the Human Heart, why we are awestruck when we view sacred architecture like the Parthenon, why we are attracted to the proportions of the famous Mona Lisa. Essentially, the human body is in resonance with the Living Mathematics of Nature.

A fascinating day that will help you to remember this Lost Knowledge of the PHI CODE that is already morphologically and geometrically encoded in your bio-magnetic and bio-electrical fields.

Ultimately, this Pythagorean Knowledge is not an intellectual process, but rather that these essential geometries are invisibly constructed and nested within the Heart as the Centre of a greater Galactic Grid connecting us to all Memory of all Universes and Atomic Levels.

This is the study of the Universe as found in all parts of the Human Body. This is the mathematics of infinity; Phi expressed as 1:1.618033 etc. The decimal part goes on forever without any detectable repetitious pattern. The Golden Mean, sometimes referred to as the The Sacred Cut or The Phi Ratio has connections with Galactic and Atomic mathematics, as revealed in ancient temples and pyramids; in classical paintings like the Mona Lisa; in the cross-sectional view of the D.N.A. molecule; in the nesting of the 5 Platonic Solids; its occurrence encrypted in the Fibonacci Sequence: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144 etc.; in the counter-rotating fields or spirals of the sunflower and pine cones.

This Transcendental Number has fascinated many cultures and individuals for millennia. This Phi Ratio is part of our Ascension Process and is an important clue to accessing or Multidimensionality. The Golden ratio (the divine proportion) is morphologically and geometrically encoded in your bio-magnetic and bio-electrical fields. Today, in this course, you will study the importance of the Pentacle and the Golden Phi Spiral and learn how to draw these 2 psychoactive diagrams with compasses and rulers only. You will also learn about the 'Vesica Picses' as the mother of all symbols.

The DNA molecule is based precisely on the living mathematics of the nautilus shell, flowers and all parts of the human body.

This is the same ratio where the elbow is to the whole of the arm, or where the knee bends. It is the ideal aesthetic proportion of all parts of the human anatomy, of flower's petals and leaves, of the distance of the planets from the sun. The only mathematical sequence that encodes this is called the Fibonacci Sequence: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 89, 144 a trinity relationship of 3 numbers, where the previous number like 2, the past, is added to the present, number 3, to give the future, number 5.

A lesson in x-raying the Fibonacci Sequence : 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144 etc. to discover where the infinite phi expression has its underlying rhythm, a distinct periodicity of 24 recurring digits that cannot be seen by the Western Mathematical Eye but only by the Truth of Vortex Mathematics expressed as Vedic Mathematics! (Really this Knowledge predates the Vedas and Atlantis and is better referred to as Galactic Mathematics).

The Golden Mean Ratio is an infinite number that connects atoms to the stars. We are the Phi Ratio, whose 4th dimensional emblem is the imploded sphere known as the Tube Torus Doughnut that has no inside or outside, creates vorticity and allows waves to travel infinitely without destruction as they embed in this vital Phi relationship, the Golden Mean Spiral.

The key word for the Divine Proportion or Phi Spiral is "Shareable" in that the key for waves to survive is to be aligned to the Phi Ratio of 1:1.618, this shareability of wavelengths allows a passport into the multidimensional worlds. Ultimately, if something is not shareable, it has no value, it will die, it has no spin, no life-force. The Divine Proportion is the Living Mathematics of Nature that is our template for survival.

Learn why the history of the Pentacle and the '3-Dimensional Phi Spiral' have been suppressed over the last 2000 years. Have you wondered why the following 3 subjects: Magic Squares, Vedic Mathematics and the Phi Ratio (1:1.618) have not been taught in your math classes? They are keys to your ascension process.

Sacred Geometry

The 5 Platonic Solids is the Key to Atomic Structure and Alchemy. This is the Language of Shape. A language that developed from our Ancestors original measurements of the Earth's circumference. It involved a study of the Stars and therefore connected us to the big Picture or Macrocosm which our Ancestors believed was a mirror of the Small, Atomic, D.N.A. Picture or Microcosm.

Multidimensional Geometry

This material shakes the whole foundation of current Western Quantum Physics.

The Five Platonic Solids, the only 5 shapes that fit inside a sphere with equal angles, faces and edges, are the key to Atomic Structures, as expounded by Charles Leadbeater and Buckminster Fuller.

Explore the hidden mysteries within the 5 Platonic Solids which are the key to nuclear geometry. What is the importance of the Star Tetrahedron (the 3-Dimensional version of the Star of David) having 24 faces and 24 edges?

How does this link to the 24 edges of the Cuboctahedron, the compressible and alchemical shape that was revered by Buckminster Fuller (who designed the first geodesic domes).

A day for exploring the hidden mysteries within the 5 Platonic Solids. Learn how the ancient masters, like Pythagoras, 2,500 years ago were aware that all atomic structure was essential based upon the nesting of these 5 universal shapes. e.g.: the atomic structure of Oxgygen is the Icosahedron (20 faces) with a Tetrahedron (4 faces) nested within.

Explore also the 13 Archimedean Solids which are a subset of the Platonic Solids. You have been kicking around one of these Shapes, the Truncated Icosahedron which you know as a Soccer Ball: the Fusion of Pent and Hex as found in the D.N.A. Molecule!

This was also known by the Theosophists 100 years ago who promulgated the teachings of Charles Leadbeater, a siddha yogi who could travel into the Macrocosm eg: to the moons of Jupiter and describe it in full detail, or travel into the Microcosm e.g.: to describe atomic structure based purely upon the 5 Platonic Solids. Modern Technology today has verified his findings of 100 years ago to be true! How did he do this? Inner Merkabah (the inner spiritual vehicle of Light) versus Outer Merkabah (Technological Space Craft made of heavy metals).

You will understand that the Dodecahedron (having 12 pentagonal faces) is the 3-Dimensional view of the Pentacle. That the Star Tetrahedron is the 3-Dimensional view of the Star of David. This is the cubic shape of our first 8 original cells of life.

As we begin to view our own D.N.A. and the shapes of our first mitotic divisions since fertilization we realize that all these sacred shapes are actually part of our Genetic Memory. e.g.: our first 4 cells pack into a Tetrahedron of 4 spheres.

Why did the symbol of the Pentacle, the Swastika, the Number 13 and the Ram's Horn (which is the 3-Dimensional view of the Nautilus Shell Phi Spiral) all become "demonized". Was it to create fear around these shapes so that you could not access the Memory of who you really are?

Every child at school could be learning the origin of where "A,B,C and 1,2,3" come from, as the marriage of the male Tetrahedral Pyramid and the 3-Dimensional feminine Golden Mean Spiral of the Nautilus Shell or Ram's Horn. When we shine a laser upon this union of primal male and female shapes, the shadow produces the Language of Light, that is, every main language has its origin in Sacred Geometry.

These shapes are psychoactive and raise consciousness by merely gazing upon them. The Hands-on Activity for this Module is the drawing of the Pentacle within the Circle, the Mystical Squaring of the Circle, and the true angle of the Cheops Pyramid, all in one important diagram.

Ancient Puzzle: How many spheres can pack around a central sphere, all the same size, touching or kissing one another. If you were to join the centre of those surrounding spheres, what shape would you get?

Is "SHAPE" the key to all Future Technologies? Does SHAPE STORE MEMORY? "Mem" = "Water" and "Ori" = "Light" in ancient Hebrew. i.e: Memory is Liquid Light! and our Brain is 90% Water.

Bridging Physics to Metaphysics by understanding the work of Charles Leadbeater and Annie Besant who, 100 years ago, drew all known atomic structures of the elements of the periodic table. In fact some recently discovered isotopes have been drawn 100 years ago! Having associated with yogis, this Pair of Clairvoyant Chemists were also able to successfully describe the moons of Jupiter, confirmed now by NASA! This material actually validates Jain's life's work: that when the numbers of certain Magic Squares, like the

Magic Square of 3x3, which is the centre of the Tibetan Calendar, when tiled or tessellated into a larger matrix actually shows the shadow form of the 3-Dimensional view of the Atomic Structure of Diamond-Lattice!

This material shakes the whole foundations of the current Western mathematics curriculum, will rewrite our current world view on Mathematics and will require a new definition of the Golden Mean: that its decimal does carry on infinitely but within its infinity there is recursive or self-similar beauty. Scientists like Marco Rodin wind toroidal coils in sync with this recursion or rhythm or pulse or pattern of 24 digits to get more output than their input! The sum of these 24 digits is 108 (108 degrees being the external angles of the pentagram and the number of beads in a rosary) which is sonically disguised as the GAYATRI MANTRA, the most famous Eastern prayer for Enlightenment.

Sacred Geometry: This is the Language of Shape. A language that developed from our Ancestor's original measurements of the Earth's circumference. It involved a study of the Stars and therefore connected us to the big Picture or Macrocosm which our Ancestors believed was a mirror of the Small, Atomic, D.N.A Picture or Microcosm. It involved a Universal Language of symbols that anyone on any planet or any time, could read.

A Language of Light operating via the Right Hemisphere of the Brain that understands Pictures, Colors, Shape, Holographs. "Shape" will be future technology, the ability to visualize in your Pineal Gland a certain shape that will create that image visualized to manifest. Sacred Geometry, relating to this concept of "Shape" poses the next advancement in our quest to ask: "How can we use this Knowledge of 'Sacred Geometry' and 'Shape' to solve all our mathematical multiplications, mentally, in our head, without using the calculator? This now leads to the next door, called: Vedic Mathematics. (Definition By Jain, 2005)

5 Platonic Solids

An Ancient Puzzle: What shapes can fit inside of a sphere, where every line or edge, every face or polygon and every corner or vertex are the same? There are only 5 such shapes, the most common one being the Hexahedron or Cube. They relate to the 5 elements: Fire is the Tetrahedron (having 4 equiangular triangles), Earth is the Cube (have 6 squares), Air is the Octahedron (having 8 equiangular triangles), Water is the Icosahedron (having 20 equiangular triangles), and Ether is the Dodecahedron having 12 (pentagonal faces). These 5 shapes have been found carved in stone from 10,000 years ago and can be seen in a museum in Oxford.

Charles Leadbeater, the occult chemist and Theosophist, described all atomic structures as the nesting, like the Chinese dolls, of these Platonic Solid symmetries, e.g.: Oxygen has a small tetrahedron inside of a larger Icosahedron. Many scientists see these shapes in their experiments and in the natural world: e.g.: when a wet straw is inserted into a large spherical soap bubble, and someone sucks into the straw, forcing the bubble to collapse or compress or minimize its surface area, it does this optimally to form the dodecahedron. (Definition By Jain, 2005)

Pythagorean Mystery School

Pythagoras was contemporary to Buddha and Lao Tzu who lived accomplished lives 2,500 years ago. Born in Sidon, Lebanon, Pythagoras studied 25 years alone with the Egyptian priests, then set up school in Greece but due to political unrest he was forced to move to Crotona in northern Italy where he set up his Mystery School that accommodated both men and women, promoted fasting, and the community sharing of goods, and other strict morals.

Oaths were taken in high secrecy not to reveal the true knowledge of the 3-Dimensional form of the Pentacle, known as the Dodecahedron ("do" in Greek means 2, and "dec" means 10, thus "dodec" means 12, "hedron" means face). The Dodecahedron was the 5th Element symbolizing the Ethers or Spirit, and is linked to the DNA molecule. He is known as Father of Music, having developed the structure of musical intervals that we now use today.

Pythagoras' 'Monochord' was a unit string that was plucked at its midpoint to give the 'octave' and other proportions like thirds and quarters and fifths, these ratios became known as "Logos" or divine 'proportions' and captured the planetary "Music of the Spheres".

Due to further political problems, rumors have it that the whole Pythagorean community were burnt alive. It is for this reason that many modern lecturers today, who have some memory of this time, still register the fear associated to teaching "sacred Geometry", as the witch hunt or destruction of Ancient Knowledge, is still carried on in this modern age, where all sacred symbols like pentacles and swastikas and magic squares are demonized.

Divisibility Rules

1 Two (2)	If a number has the last digit on the right hand side as 0, 2, 4, 6 or 8, the whole number is divisible by 2.
2 Three (3)	If the sum of the digits of a number is divisible by 3, the whole number is divisible by 3.
3 Four (4)	If the last two digits on the right hand side of a number are divisible by 4, the whole number is divisible by 4.
4 Five (5)	If the last digit on the right hand side of a number is 5 or 0 then the number is divisible by 5.
5 Six (6)	If a number is even and also divisible by 3 then the number is divisible by 6.

6	Eight (8)	If the last three digits on the right hand side of a number are divisible by 8 then the whole number is divisible by 8.
7	Nine (9)	If the sum of the digits of a number is divisible by 9 then the whole number is divisible by 9.
8	Ten (10)	If a number ends with 0 the number is divisible by 10.
9	Eleven (11)	If the sums of the alternate digits of a number are equal, the number is divisible by 11.
10	Twelve (12)	If a number is divisible by 4 as well as 3 the number is divisible by 12.
11	Fifteen (15)	If a number is divisible by 3 as well as 5 the number is divisible by 15.
12	Eighteen (18)	An even number divisible by 9 is also divisible by 18.
13	Twenty-five (25)	If a number ends with 25, 50, 75 or 00 the number is divisible by 25.
14	Thirty-three (33)	If a number is divisible by 3 as well as 11, it is divisible by 33.

Today you can define mental math in various different ways. Some would say, memorizing times table and remembering the solutions can form the part of mental mathematics. Some would say ability to perform simple calculations in your head can be mental mathematics. The web dictionary defines mental mathematics as "Computing an exact answer without using pencil and paper or other physical aids." Today there are five methods available to learn and practice mental mathematics.

Let's begin with the first one called 'Learning by Heart' or better known as the rote memorizing method where your teachers ask you to mug up boring multiplication tables. It not only kills the interest of the child in mathematics but also makes sure that he develops hatred towards the subject for the rest of the years he studies it. This system gives its ardent devotee some degree of success initially as he is able to answer easy problems but then when the supposedly bigger application problems come the steam is almost over. The second one gives you a good degree of success and I would highly recommend it to the younger lot out there.

It hails from China and is popular by the name of The Abacus (also known as the Soroban in Japan). An abacus is a calculating tool, often constructed as a wooden frame with beads sliding on wires. With the use of this tool one can perform calculations relating to addition, subtraction, multiplication and division with ease. Gradually one practices with the tool in one's hand and later on when experienced he learns to do it without the tool. This tool is then fitted into the mind mentally and he can then add, subtract multiply and divide in seconds. This tool also enhances a child's concentration levels.

The main drawback of this system is that it focuses only on the 4 mathematical operations. Concepts beyond these operations such as Algebra, Square Roots, Cubes, Squares, Calculus, and Geometry etc. cannot be solved using it at all. Also one needs a longer time to be able to fully get a grasp of the system hence you see courses in the abacus stretching to over 2 years which leads the child to boredom and then quitting from the course. Another Chinese system mainly collected from the book The Nine Chapters on the Mathematical Art lays out an approach to mathematics that centres on finding the most general methods of solving problems.

Entries in the book usually take the form of a statement of a problem, followed by the statement of the solution, and an explanation of the procedure that led to the solution. The methods explained in this system can hardly be termed mental and they lack speed to top it all. The Chinese were definitely the most advanced of the civilization thanks to the

Yangtze and Yellow Rivers but if I were to choose out of the two methods given by this culture It would be the abacus. If wars have a 99.99% downside, sometimes they can have an upside too for they give birth to stories of hope and creativity.

The next mental math system was developed during the Second World War in the Nazi Concentration Camp by a Ukrainian Mathematician Jakow Trachtenberg to keep his mind occupied. What resulted is now known as the Trachtenberg Speed System of Mathematics and consists of Rapid Mental Methods of doing Mathematics.

The system consists of a number of readily memorized patterns that allow one to perform arithmetic computations very quickly. It has wider applications than the Abacus and apart from the four basic operation methods it covers Squares and Square Roots.

The method focuses mostly on Multiplication and it even gives patterns for multiplication by particular number say 5,6,7 and even 11 and 12. It then gives a general method for rapid multiplication and a special two finger method. After practicing the method myself I realized that the multiplication was a very applicable mental method but the other methods covered to solve division and square roots were not very friendly and were impossible to be done mentally. I was in search of a much better wholesome method where I could easily perform other operations also.

Another drawback of this system was that it too like the abacus failed to have a wider scope i.e to encompass other fields like Algebra, Calculus, Trignometry, Cube Roots etc. A Recommendation by a friend of mine from America introduced me to what is known as the Kumon Math Method. It was founded by a Japanese educator Toru Kumon in 1950s and as of 2007 over 4 million children were studying under the Kumon Method in over 43 different countries. Students do not work together as a class but progress through the curriculum at their own pace, moving on to the next level when they have achieved mastery of the previous level. This sometimes involves repeating the same set of worksheets until the student achieves a satisfactory score within a specified time limit.

In North American Kumon Centres, the mathematics program starts with very basic skills, such as pattern recognition and counting, and progresses to increasingly challenging subjects, such as calculus, probability and statistics. The Kumon Method does not cover geometry as a separate topic but provides sufficient geometry practice to meet the prerequisites for trigonometry, which is covered within the Kumon math program. I was much impressed with the glamour around Kumon but a glimpse of its curriculum deeply disappointed me.

It is not mental at all. It does not offer any special methods to do mathematics and one does not improve one's speed by doing Kumon Math. There is a set curriculum of worksheets which one does till one achieves mastery in the subject. So say for example a sheet on Divison- one would continue to do division by the conventional method till he gets a satisfactory score and then he moves on to a higher level. This certainly doesn't make division any faster and the process is certainly not mental. A deep thought on the reason of its tremendous popularity in America led me to conclude was the lack of a franchisee business model of the abacus and the Trachtenberg speed system in the 1950s.

The franchisee model was essential in taking the course from country to country. This is where Toru Kumon thrived. Dissapointed with other cultures in the world, my search made me look in my own Indian culture. What I found astonished and amazed me so much that I fell in love with the system and started coaching neighbourhood students in it. This is easily the World's Fastest Mental Mathematics System called High Speed Vedic Mathematics. It has its roots in Ancient Indian Scriptures called the Vedas meaning 'the fountain head of knowledge'.

With it not only you can add, subtract, multiply or divide which is the limiting factor of the abacus but you can also solve complex mathematics such as algebra, geometry, Calculus, and Trigonometry. Some of the most advanced, complex and arduous problems can be solved using the Vedic Maths method with extreme ease. And all this with just 16 word formulas written in Sanskrit.

High Speed Vedic Mathematics was founded by Swami Sri Bharati Krishna Tirthaji Maharaja who was the Shankaracharya (Monk of the Highest Order) of Govardhan Matha in Puri between 1911 and 1918. They are called "Vedic" as because the sutras are contained in the Atharva Veda - a branch of mathematics and engineering in the Ancient Indian Scriptures. High Speed Vedic Mathematics is far more systematic, simplified and unified than the conventional system.

It is a mental tool for calculation that encourages the development and use of intuition and innovation, while giving the student a lot of flexibility, fun and satisfaction . For your child, it means giving them a competitive edge, a way to optimize their performance and gives them an edge in mathematics and logic that will help them to shine in the classroom and beyond.

Therefore it's direct and easy to implement in schools - a reason behind its enormous popularity among academicians and students. It complements the Mathematics curriculum conventionally taught in schools by acting as a powerful checking tool and goes to save precious time in examinations. The Trachtenberg Method is often compared to Vedic Mathematics. Infact even some of the multiplication methods are strikingly similar. The Trachtenberg system comes the closest to the Vedic System in comparison and ease of the methods. But the ease and mental solvability of the other method especially division, square roots, cube roots, Algebraic Equations, Trigonometry, Calculus etc. clearly gives the Vedic System an edge. Even NASA is said to be using some of this methods applications in the field of artificial intelligence.

There are just 16 Vedic Math sutras or word formulas which one needs to practice in order to be efficient in Vedic Math system. Sutras or Word Math Formulas such as the Vertically and Crosswise, All from Nine and Last from ten helps to solve complex problems with ease and also a single formula can be applied in two or more fields at the same time. The Vertically and Crosswise formula is one such gem by which one can multiply, find squares, solve simultaneous equations and find the determinant of a matrix all at the same time. If either of these methods is learned at an early age, a student aged 14 can perform lightening fast calculations easily during his examinations and ace through them. Vedic Mathematics is fast gaining popularity in this millennium. It is being considered as the only mental math system suited for a child as it helps to develop his numerical as well as mental abilities. The methods are new and practical and teach only Mental Rapid Mathematics. The system does not focus on learning by repetition as in the Kumon Method. The system focuses on improving intelligence by teaching fundamentals and alternate methods. The purpose is not limited to improving performance in the school or tests, but on providing a broader outlook resulting in improved mathematical intelligence and mental sharpness.

3

Glimpses of Vedic Mathematics

Vedic mathematics was lost to the modern world over several thousand years. Fortunately, the renowned scholar Jagadguru Swami Bharti Krishna Tirthahji Maharaj, Shankracharya of Sharda Peeth and Goverdham Math discovered 16 Vedic Sutras and 13 Upsutras in the Parishistha of Atharvved. After continuous Sadhana and hardwork, he was able to decode them and get wide ranging mathematical principles and applications from them. He found that these Sturas cover all aspects of mathematical science in depth. He wrote sixteen volumes on Vedic mathematics covering all aspects of these sutras in depth. Unfortunately, the manuscript was lost which fact was finally confirmed in 1956.

During his last days when his health was failing and his eyesight was weak, he rewrote from his memory an introductory account of the subject. He attained Mahasmadhi in 1960. Later in 1965 a book entitled "Vedic Mathematics" was published. This book is edited by Dr. V.S.Agarwala with the help of Smt. Manula Trivedi on the basis of manuscript and notes left by Swamijee. This book is therefore, the first book to give a glimpse of Vedic mathematics and to reestablished the subject. The book attracted the attention of several Indians and foreigners. Dr. Narinder Puri of

Roorkee University took up the cause of Vedic Mathematics in right earnest. His Holiness Maharishi Mahesh Yogi spread the message of Vedic mathematics throughout the world by sending Dr. Puri to several countries and making it possible for many schools all over the world start teaching Vedic mathematics. A former minister of Human Resource Development, in the Government of India, Sh. P.V.Narasima Rao made a reference in Parliament about the work on Vedic mathematics which created a wider interest in the nation. Rashtritya Ved Vidya Pratishthan started looking into the matter and appointed a committee on Vedic Mathematics. During the same period a controversy arose about the source of these 16 Sutras and the level of mathematics contained in them. One view was that these Sutras do not have a Vedic source and that they deal only with simple arithmetical operations.

In the meantime, Dr. Sant Kumar Kapoor, inspired by integrated impact of the Ganita Sutras, started working on basic aspects of the mathematical structure of Vedic literature. He got several clues from Ganita Sutras, Maheshwara Sutra and many other Vedic Mantras. He was inspired by the divine blessing from Yograj Sri Sripad Babaji of Vrindavan and His Holiness Maharishi Mahesh Yogiji at Maharishi Nagar. He has been awarded Ph.D. degree by Kurukshetra University, in December 1990 on his thesis titled "Mathematical Basis of Vedic literature". His work shows that the potential of Ganita Sutras is much higher than what appears in the book "Vedic Mathematics" and the mathematical structure of Ganita Sutras is similar to that of Samved indicating that Ganita Sturas belong to Vedic family. His work shows that the Devnagri alphabet and the Vedic scriptures are mathematically organized. Perhaps a more important aspect of his work in the existence of Real Geometric Spaces of higher dimensions in the form of a continuum. A comprehensive description of his research is given in the next section. Dr. Sant Kumar Kapoor is presently working as a Visiting Professor in the Indian Institute of Maharishi Vedic Science & Technology which is a part of Maharishi Ved Vigyan Vishwa Vidyapeeth, Maharishi Nagar. Three research students are working in our institution on the structure and properties of fourth, fifth and sixth dimensional spaces.

Why Vedic Mathematics?

The questions which should be addressed are as to why the modern mathematics is held up, why its logic recoils upon itself and why there are mathematical problems, logical knots and mental blocks at all in the modern mathematical approach?

Well known problems of modern mathematics may be cited as:

1. Everywhere continuous but nowhere differentiable functions
2. Hypercubes 1 to 7 increase but hypercube 8 onwards decrease
3. Space Filling Curves
4. Riemann Hypothesis
5. Goldbach's conjecture
6. Fermat's Last Theorem

Isn't it that these problems are there because of the axioms accepted by the modern mathematics?

And then follows a question as to whether Vedic mathematics is in a position to help the modern mathematics to come out of its mental block and to untie its logical knots and to solve the problems?

The Vedic geometric concepts worked out in the books of Dr. Kapoor promise us geometric comprehensions of our existence phenomenon transcending our existing three space format. The real four and higher spaces formats of Vedic comprehensions are new wonderful worlds of very rich mathematics which may ensure us powerful technologies and much potentialised disciplines of knowledge. The basic comprehension pointed out is the way the cosmic surface constitutes and binds the solid granules as synthetic solids manifesting in the cosmos.

Dr. Kapoor is attempting to reconstruct the discipline of geometry as a discipline based on Vedic concepts. He has designated this discipline as Vedic Geometry. His results has added a new dimension to the dialogue initiated with the interpretation of the Ganita Sutras and their potentialities brought to focus by Swami Bharti Krishna Tirthaji Maharaj.

Dr. Kapoor's conclusion is that this all is there only because of the acceptance of the geometric entity (monad) admitting no parts, and "1" has no predecessor. To overcome this, as per him, the modern mathematics needs Vedic mathematics' help to shift from monad without parts to a monad admitting parts. The eliptic equations format $y^2 = x^3$ is bound to give a conceptual slip and this, as per him, can be well glimpsed by chasing the format of this equation on simplex format to see how it is deceptive to appear to be so while as whole numbers artifices parallel to the dimensional frames is well evident inequality. As such, there is a need for the modern mathematics to re-address to itself about the need for re-settlement of the basics to come out of the mental blocks and logical knots to untie the knots and to transcend the blocks and to be face to face with the wonderful worlds of reality awaiting ahead with all potentialities of their structural richness. The parallelism between artifices of whole numbers 1 to 26 and 26 sporadic groups is there because of the cosmic surface within the solids.

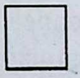
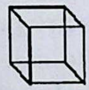
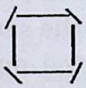
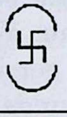
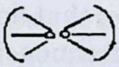
The recent academic research attempts and teaching experiments with the help of Vedic mathematical operations demonstrate their potentialities to provide the desired help.

The research results are bringing us nearer the traditional acceptance as that Vedas are written on the rays of the Sun. Vedic mathematics, science & technology is the mathematics, science & technology of the way the nature maintains grand unification of the existence phenomenon on the Earth through the rays of the Sun. It is in this grand design of the nature the individual Vedic mantras are impulses of consciousness. This design maintains the continuity of the life within human frame and beyond through the natural intelligence embedded in the human mind and in the rays of Sun. This continuity and parallelism when chased promises new wonderful experiential domains about new realities and the wonderful domains to unfold for us new disciplines of mathematics, science & technology.

Vedic sounds are multidimensional domain frequencies from within the particular dimensional frame as the structure of that domain. When the sounds are pronounced, the frozen frequencies get initiated and the self-organizing power of the Vedic sounds set the frequency's potentialisation process into action. It is this process whose utilization is the aim of different Vedic scriptures. Rig Ved Samhita is the first Vedic scripture. It is the first book of the mankind. The mathematics precedes the composition of Rig Ved Samhita. Vedic Mathematics helped to transform the universal set of knowledge as a speaking language and in the process it itself as well transformed as such and assimilated its identity into the Vedas. Within Vedas, all discipline of knowledge transform their identity and get assimilated into the single discipline of organization of knowledge on geometric formats. Vedic geometry and mathematics as such help us to work out these formats.

Vedic Mathematical Research

Studies reveal that knowledge and organisation of knowledge are two distinct disciplines. The thesis of Dr. S.K.Kapoor is substantively covering the organisational aspect of Vedic knowledge. The main results of the thesis and his subsequent research can be summed as under: 1. Real 4 and higher dimensional spaces do exist. Real 4 and higher dimensional spaces were not only known to the Vedic seers but those were precisely availed by them for organisation of vedic knowledge. Vedic alphabet format is a precise setup of 4-space. The alphabet letters of Devnagri script, their forms formulations, combinations and rules etc. are precisely mathematical. Sakala Rigvedic Samhita is the oldeset scripture of mankind. The organisational format of this Samhita is precisely that of real 6-space. Vedic knowledge accepts a measuring rod constituted by regular bodies of the first six real dimensional spaces which admit formulations as:

Interval	Square	Cube	Hypercube-4	Hypercube-5	Hypercube-6
					
1-space body	2-space body	3-space body	4-space body	5-space body	6-space body

The organisational format of Srimad Bhagwad Gita emerges to be of prime importance as it is parallel to the organising power of the knowledge content of the scripture. This format tallies with the format of human body on the one hand and the sun on the other hand as of real 6-space. The Trinity of Gods namely Brahma, Mahesh, Vishnu are the overlords of real 4, 5 & 6 spaces respectively. The geometrical continuum expressed as manifestation layers of 4 folds of consecutive dimensional spaces contents. These folds of the nth manifestation layer can be represented as under:

First Fold	Second Fold	Third Fold	Fourth Fold
Dimension	Frame	Domain	Origin
(n-2) space content	(n-1) space content	n-space content	(n+1) space content

The transcendence from one manifestation layer to another manifestation layer giving rise to the following (five steps) chain reaction or five steps which are possible within the setup of Panch Mahabhut.

Manifestation Layer	Dimension	Frame	Domain	Origin
nth	Space fold (n-2)	Space fold (n-1)	Space fold n	Space fold (n+1)
(n+1)th	Space fold (n-1)	Space fold n	Space fold (n+1)	Space fold (n+2)

Transition from one space to another space is to be had in terms of unlocking of the seals of the origin points of all the four folds of the manifestation. The modern mathematical models of transition from straight line to plane deserve serious reexamination. In particular the axioms of space filling curves and the axioms of 'one' without a predecessor deserve close scrutiny as their rationale emerges to be without basis.

The role of real numbers additive group (R,+) and real numbers field (R,+,×) with reference to straight line deserve to be differentiated.

The plane deserves to be studied as four geometrically distinct quarters. One faced plane and two faced plane are two distinct geometrical setups and they deserve to be taken up as such.

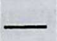
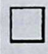
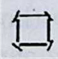
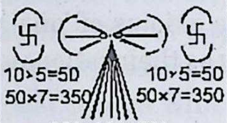
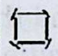
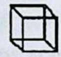
The concepts of origin and dimension are two concepts with respect to which the modern geometrical models are not up to date. These two concepts deserves to be studied in detail as transcendence to the higher dimensional spaces is possible only in terms of their understanding.

Human body is a compactified phenomenon of multi-layer physiological existence. The start with state of existence is that of waking state which is parallel to the expression of 1-space as dimension into 3-space domain. Sequentially, the existence phenomenon unfolds until seventh state of consciousness which would be corresponding to the 7-space as dimension into 9 space domain. The origin point of the 6-space, being the 7-space setup, the human body, geometrically, turns out to be hypercube-6 and this would explain how the primordial sound, the planetary effects, the

Yajna oblations etc. operate and precisely influence the individual existence patterns.

Srimad Bhagwad Gita is one such scripture whose organisational format precisely workout for us the structural set up and frames of the 6-space. The study zone of Srimad Bhagad Gita can be worked as under:

Srimad Bhagwad Gita
Study Zone

$a/2$	$a^2/4a$	$a^3/6a^2$	$a^4/8a^3$	$a^5/10a^4$	$a^6/12a^5$	$a^5/10a^4$	$a^4/8a^3$	$a^3/6a^2$	$a^2/4a$	$a/2$
										
2×1 =2	4×2 =8	6×3 =18	8×4 =32	10×5=50 50×7=350		10×5=50 50×7=350	8×4 =32	6×3 =18	4×2 =8	2×1 =2
Orbitals				350+350=700						
2	6	10	14	18=5+6+7						

The organisational setups of Ganita Sutras, Maheshwara Sutras, Saraswati Mantras, Gyatri Mantra and Om formulation deserve interdisciplinary explorations.

Sankhay Nistntha and Yoga Nistha are complementary and supplementary of each other and as such their complementary nature and supplementary nature deserve to be distinguished well. Non-differentiation of the same is bound to deprive us of most of the results in specific forms.

Ganita Sutras

Ganita Sutras is a complete system in itself. These are Vedic aphorisms. These are 29 in number; 16 of them are designated as Sutras and other 13 as Upsutras. Credit goes to Swami Bharti Krishna Tirthaji Maharaj, a Shankracharya of Kanshipeeth to focus the attention of the present generation about potentialities of Sutras.

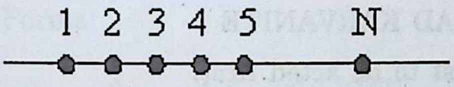
The information contained in the book titled "Vedic Mathematics" compiled by Prof. V. S. Agarwala, published (1965) from the manuscript papers of Swamiji make us known as how Swamiji had to devote many years to decode the working rules of these Sutras.

From the demonstrations of the working rules of these Sutras in this book it has convinced many about the potentialities of the Sutras. Since then many scholars have further demonstrated about their potentialities to make the mathematics much easier and more effectively within the comprehensions of much larger population and also about their utility and academic values in many ways. Dr. S. K. Kapoor has approached the organization format of this system on the whole and as individual Sutras. His approach and the results give us further insight of this wonderful system.

Here Sutras 1, 2 & 3 and Upsutras 1 & 2 are being introduced from the book "Goldbach Theorem" to give insight about their formats and to give idea about the basics of the different processes and the way this system is approaching different branches of mathematics in a unified way as a single discipline. The parallel text of the Sutras adopted in different scriptures is being searched. Dr. Kapoor points out Shatpath Brahman. Hereunder, the illustrative reference with working rule is indicated in reference to Ganita Sutra 1. The other Sutras may be taken up in due course of time.

GANITA SUTRA 1

Format:



Basics/Technical Words

Text avails three technical words which take us to the basics of the working domain of the Sutra. These are: (1) Eka (one), (2) Edhikena (more than), and (3) Purvena (previous). These three technical words take us to the three basic concepts: (1) the concept of "one", (2) the concept of "one more than", and (3) the concept of "previous one". The first concept is the wholesome concept. Here it manifests in many ways and can be availed as a unit, unit entity, unit measure, the counting number 1, the close interval of unit length, etc., etc. The second concept "more than" is the concept of increase, the concept of comparison of one entity being bigger than/ more than other entity. The third concept is the concept of "order". It is the concept of a queue, a pair of entities of a queue of which one is previous as comparison to the second and the second automatically being subsequent to the first. Therefore, the Sutra 1 has many applied values which would work out for us (1) counting, (2) arrangement of counting pebbles, (3) arrangement of beads along a thread, (4) the queue of points along with line, etc. If we try to chase the repeated applications of "one more than the previous one", we can have a countably infinite steps. Not only that, we can by a suitable choice of "one" and the application of the working rule of Sutra 1, have a chase for uncountable infinity as the line is by having sequential placements of points as counts with index values allotted as per the working rule of Sutra 1 from the set of natural numbers (whole numbers/ counting numbers).

Parallel text and application of Sutra 1 in Shatpath Brahman:

1.1.2.5 (Kanda 1, Parpathaka 1, Brahmana 2, Kandika 5) Page 10

YADEV AGRE TAD KARVANITE

That which is first to be acted first.

2.5.2.22 (Kanda 2, Parpathaka 5, Brahmana 2, Kandika 22) Page 300

EKAIN EKEIN YA ASYE PRAJA .... EKE NATI RIKTANI

For everybody there is one utensil. As many are the members of the family,

so many are the utensils and there is one extra.

2.6.2.4 (Kanda 2, Parpathaka 6, Brahmana 2, Kandika 4) Page 328)

EKAIN EKEIN YA ASYE PRAJA .... EKE NATI RIKTANI

For everybody there is one utensil. As many are the members of the family,

so many are the utensils and there is one extra.

Let there be a family F of members m1, m2, ...mf. Let this family has a kitchen K with utensils

u1, u2, ...uk.

For one-to-one association of family members of F with the utensils of K, the first member m1 is to be associated first, the first utensil of K i.e. u1.

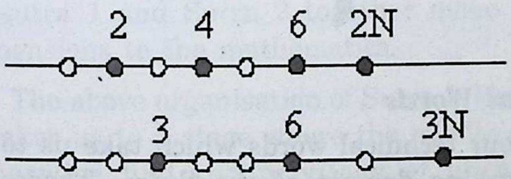
To each member of F is associated from K.

The requirement is that after such association we should have one extra utensil in K. This makes the cardinality of K as f+1.

The set F (of cardinality f) and the set K (of cardinality f+1) makes a pair of sets (F, K) and they supply us the pair of numbers (f, f+1). This is precisely the basics and formation of Ganita Sutra 1.

GANITA UPSUTRA 1

Format:

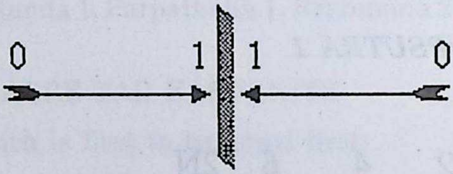


Basics/Technical Words

The text of Upsutra 1 avails a pair of technical words: (1) Anu (to follow), and (2) Rupyena (the form of). When 'one' is viewed as synthetic i.e. composed of parts, then each of its parts would be symmetrical to the whole and it would be proportionate of the whole. As such, (1) part as symmetrical to the whole, and (2) part as proportionate of the whole would be two distinct aspects of the same organisation. Infinity is another word in which melt away all finiteness. In infinite domains or self-contained domains, the uniformity and patterns are other keywords in terms of which the concept of oneness can be approached as a symmetry and proportions. The applied values of Upsutra 1 would help us reach at unit interval as replica of infinite line, the universality of Yatha pinde tatha brahmande (as in the body so in the universe) and Yatha brahmande tatha binde (as in the universe so in the body) as well as the universality of the Upanishadic comprehensions as that even when full is taken out of full, there still remains full. With this, when one would work Sutra 1 with double of a unit instead of a unit or with any multiple of a unit instead of a unit, one would see that the rule works. With this, the Sutra 1 coupled with Upsutra 1 makes the potentialities of Sutra 1 manyfold.

GANITA SUTRA 2

Format:



Basics/Technical Words

Text avails four technical words which take us to the basics of the working domain of the Sutra. These are: (1) Nikhilam (all), (2) Navastasca (from nine), (3) Caramam (last), and (4) Dastah (ten).

Nine numerals and ten place value system are the two basic steps in terms of which the infinitely long line stands tamed. The counting pebbles technique requires infinite pebbles for coverage of infinitely long line. However, symmetry / proportions / replica rules suggest that proper system can be constructed to express "infinity in terms of finite". Vedic seers comprehended ten place value system. From the method of expression tenth counting pebble as 10 as in two digit form, we can notice that here lies a shift from single digit expression for first 9 counts to the next multiple digit expression initiation for expression of tenth count onwards. We also know that first 9 counts as well can be expressed in double digit forms as: 01, 02, 03, 04, 05, 06, 07, 08 & 09. Therefore, the first thing about this transition is the introduction of the tenth symbol for the zero count as "0". Further, it also would be interesting to note that the double digit form for 1 as 01 provides us an expression for the tenth count as 10 simply by having swapping of places for first and the second digit. Further, the above interlink of 01 and 10 takes us to their link and inerlocking as reflection pair of numbers as much as that the formats beneath 01 and 10 get interconnected like image of an arrow through looking mirror gets interlocked with the arrow itself. The placements of arrow, mirror, and the image of the arrow work out a dimonad format with mirror playing the role of joint of the diamond. This as such is a big leap forward from the organisation format of Sutra 1. This had become possible with the transition stage of Upsutra 1. Therefore, Sutra 1, Upsutra 1 and Sutra 2 together make much interesting dimensions to the mathematics.

The above organisation of Sutra 1, Upsutra 1 and Sutra 2 takes us to a stage where the middle of interval, which otherwise had the privilege of uncountably infinite placements, gets tamed as a unique mirror placement to have half unit in front of the mirror as first half and its image through the mirror as the second half. It is this way unique fixation of the middle makes the mathematics workable in terms of "half unit", like the organisation in terms of "half dimension". With this, it becomes possible to go to a number which exists prior to "one" i.e. half. It is a big achievement over the mathematics of "one" without predecessor.

However, simultaneously, it makes the working very delicate as we shall be permitting the second half to remain dormant while structures because of the second half also shall be silently marking their presence. We cannot afford to ignore the existence of the structures because of the second dormant half.

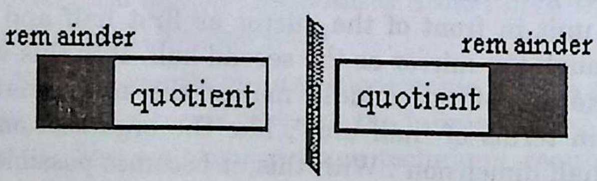
If one is to see the type of difficulties in which the mathematics when worked without taking care for the second dormant half, one is simply to pose to oneself as to why from hypercircle-8 onwards the values start decreasing. It simply happens as the linear order worked in terms of half-dimension helps us sequentially increase only uptil seventh step parallel to the possible seven geometries of 3-space of linear order.

The organisation of pairing of two halves with the help of a mirror at the middle is unique organisation of many features, of which the most important is the feature of common remainder for both the halves while both halves are divided by a common divisor.

Though this property may appear to be obvious but in fact when the same is viewed in the context of uncountably infinite points being handled in terms of counting numbers, one would realise, how important this property of constant remainders emerges to be. This is precisely Upsutra 2.

GANITA UPSUTRA 2

Format:



Basics/Technical words:

The basic / technical word availed by the text of Upsutra 2 is "Sesa" (remainder). The text as such is the definition of remainder: remainder is that which remains (as uncovered part of the divisor, on division).

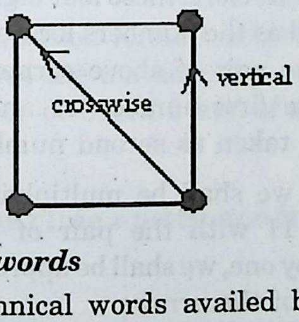
The basic operation is the operation of "division". This Upsutra along with Upsutra 1 makes the mathematics of Upsutras a very interesting branch in itself.

The "one" which permitted itself as a pair of halves, sequentially by the rule of symmetry of Upsutra 1 and the rule of equality of remainders of division of equals takes the process of partitioning of "one" into as many equal parts as one would like to have.

This makes the external expansion of counts from one to two, two to three and so on parallel to the internal partitioning from wholesome one to a pair of parts, then to three parts, four parts and so on. With this, the arrays of mathematical tools become sufficiently large to work out very rich structures only in terms of "parts", of which the working with "half" is most rewarding.

GANITA SUTRA 3

Format:



Basics/Technical words

The basic / technical words availed by the text are: (1) Urdhva (vertical) and (2) Tiryag (crosswise).

We may illustrate one of the working rules of this Sutra, which would help us to reach at its organisational format as well. Let us multiply 11 by 11. We shall be getting the product equal to 121. Let us have a close look at this number. The central digit of this number is 2. It admits expression as 1+1. Let us replace the central digit 2 with its above expression 1+1. The three parts of the number 121 would permit depiction as: 1, 1+1, 1. Now, let us chase the multiplication the Sutra way:

The first Sutra gives us the working rule to proceed step by step as "one more than the previous one". When we are working only with "half", therefore, in this case of 121 we shall be requiring the last two digits 12 or the first two digits 21. Therefore, when we shall be having 1 as start with position, as a next step under the rule of Sutra 1, we shall be reaching at 12. Then the reflection image of 12 would give us 21 and we shall be obtaining 121. If we would have been multiplying 111×111, we would be obtaining in three steps 123 and its image 321 which when combined would give us 12321 as the product of 111×111. Likewise if we would have been multiplying 1111×1111, we would be obtaining in four steps 1234 and its image 4321 which when combined would give us the required product as 1234321. The process can be extended.

The product 11×11 being the product of pair of numbers of double digits, therefore, these four digits, here each being 1, can be expressed as the numbers located at the four corners of a square. The pair of above corners may be taken as representing the first number 11 and the pair of lower corners may be taken as second number 11.

Now, when we shall be multiplying the first digit of lower number 11 with the pair of digits of the above number 11 one by one, we shall be approaching as is depicted above in terms of the arrows.

The depiction is of two parts. The first part is Urdhva (vertical) and the second part is Tiryag (crosswise). This as such, would help us comprehend as that geometric format of square is being divided into two triangles and only 1 out of two triangles is being utilised by the organisation format of Sutra 3.

Here it would be relevant to note that the triangle is the first close organisation of lines. In other words we require a minimum of three lines to have a close organisation to enclose planes (area) / surface within its lines.

The triangle as such is the printout of 3-space on 2-space. The sum of all the three internal angles of a triangle isp. The sum of all the three external angles of a triangle is 2p. We can express p as (3-2)p. The sum of all the four internal angles of a quadrilateral is 2p. We can express it as (4-2)p. In general, the printout of n-space on 2-space is n-polygon and the sum of the internal angles n-polygon is (n-2)p. This in general can be seen as that the printouts of n-space in the role of dimension on 2-space is n-polygon.

Therefore, the organisation format of Sutra 3 is that of a printout of 3-space in the role of dimension on 2-space format.

Like that, one can proceed to reach at the organisation formats of the entire range of the text of 16 Ganita Sutras and 13 Upsutras but the context and the space at hand would not permit to proceed ahead with it.

However, the organisation formats achieved uptil this stage well indicate about the mathematics of linear order of Sutra 1, spatial order of Sutra 2 and of solid order of Sutra 3.

Multi-Dimensions of Time and Space in Manasara

Vedic Wisdom

Vedic wisdom is lively in the consciousness of living saints. It is also well preserved in the Vedic literature. The inner evidence of the available Vedic knowledge of the available Vedic literature makes it out that originally the whole range of the pure knowledge i.e. Vedic knowledge was vibrating from a single wholesome Ved. Subsequently this knowledge was organized by Maharishi Ved Vyas as four Veds namely. Rigved, Yajurved, Samved and Atharvved.

The knowledge of Rigved admitted 21 branches while the knowledge of other three Veds namely, Yajurved, Samved and Atharvved respectively admitted 101, 1000 & 9 branches. The organizational format of each Vedic branch consisted of four folds designated as Samhita, Brahmana, Aryanak and Upanishad. As such 21+101+1000+9=1131 Vedic branches had 1131 Samhitas, 1131 Brahmanas, 1131 Arynaks and 1131 Upanishads. These 1131x4 = 4524 scriptures together came to be known as Vedic wisdom. In addition corresponding to each Ved, as applied value of the pure knowledge of the Ved is Upved. The four Upveds are Ayurved, Dhanurved, Gandharvved and Sthapathyaved. Our present day mathematics, science and technology come within the range of Sthapatyaupved. Manasara is one such scripture of Sthapatyaupved.

Manasara : Scripture of Sthapatyaupved

Sri Prasana Kumar Acharya had done a wonderful job of reconstructing the text of Manasara and preparing its translation in English and by drawing the plates.

The scripture begins with the prayer to Lord Brahma, the Creator, the supreme and ends with the chiseling of third eye of the idol of Lord Shiv. The broad organization of the scripture is of the range of 70 chapters with first eight chapters constituting a primary group-I. The next ten chapters i.e. chapter 9 to 18 constitute a primary group-II. Then comes the central part of the Mansara. Chapter 19 to 30 cover single story building to 12 storied buildings. These 12 chapters constitute a central group-I. Next 20 chapters i.e. chapters 31 to chapter 50 cover central group-II and with it the subject of architecture as such is completed. Then follows the subject of sculptures. The science of sculptures covered in chapters 51 to 70 can be organizationally divided in two sculptural groups. Chapter 51 to 65 constitute sculptural group-I and chapters 66 to 70 constitute sculptural group-II.

Space Time Frame

The above topical division of the text has an organizational message of great importance as in terms of it we may reach at the geometric format of the organization of the knowledge of the scripture.

As the scripture begins with the prayer to Lord Brahma, the overlord of real 4-space and ends with the chiseling of third eye of Lord Shiv, the overlord of real 5-space, therefore, geometric format at the dimensional level is bound to be spatial with the flux of time being solid.

In short, the spacetime frame at the dimensional level is going to be E2 (space) × E3 (time). In terms of this dimensional order we shall be manifesting working geometric domain within the spacetime frame (E2)4 (space) x E3 (solid time). Here (today) we shall be concentrating upon the concepts and comprehensions of dimensions of space and time in Manasara. In a way, we shall be taking up the topic of space, time and spacetime in the light of Vedic wisdom. In the context, it may be relevant to note that the modern thought, mathematics, science and technology is speculating the general spacetime frame as E3 (space) × E1 (linear time).

The modern thought, mathematics, science and technology centre around linear dimensional reality but the Vedic systems avail multidimensional reality. The studies of the organizational formats of various Vedic scriptures reveal that higher dimensional geometric formats are being availed to organize the pure knowledge. Illustratively, we may take the case of the oldest book of mankind namely, Sakla Rigved Samhita.

Rig Ved Samhita

Fortunately Rigved Samhita is intact with us from first syllable to the last syllable and as the tradition goes, the whole range of Vedic knowledge is lively in this scripture of 432000 syllables, out of which 397265 syllables are manifest text while remaining 34735 syllables go deep as organisational format of the text and as such remain un-manifest.

For the present, we may accept it an axiom that knowledge and organisation of knowledge are two distinct aspects of knowledge. Being scriptural text, we get the organised knowledge and as such both organisation format and the text are to be accepted as the knowledge content of the scripture. It is like a truck with goods yielding weight of the truck as well as of the goods loaded in the truck.

Organisation of Rigveda Samhita

Total knowledge contents	432000 Syllables
Manifest text	397265 Syllables
Mandals	10
Ashtaks	08
Chapters	64
Anuvaks	85
Suktas	1028
Vargas	2024
Richas	10552

Mathematical Basis

Mathematical basis of the organisational format of the Rigveda Samhita reveals that the Vedic knowledge is organised on geometric format of real 6-space. It admits 4-space in the role of dimension while modern thought, mathematics, science and technology centre around 3-space reality and as such Veds are invincible fort for the modern mind. As such, we have to learn and understand the Vedic wisdom. For this we have to re-examine the rationale and basis of our axioms and postulates for accepting the reality as linear dimensional one. It is only by approaching the Vedic knowledge, the Vedic way, that we may have real bliss of Vedic wisdom.

Higher Dimensional Reality

Mathematical Basis of Vedic Literature

Studies of mathematical basis of available Vedic literature reveal that 4 and higher dimensional reality was not only known to the Vedic seers rather the great use thereof was made by them for organization of pure knowledge.

Let us concentrate upon the nature of space around us. We can see that straight line is a track of a moving point while plane is a track of a moving (straight) line. Likewise, moving plane shall be creating solid space. More precisely, if we reinvestigate this phenomenon with the help of a point, interval, square and cube, we shall be noticing that moving point accepts line as its track, moving interval accepts square as its track and moving square accepts cube as its track. This would pose a question: What is the nature of the track of moving cube/solid /3-space body/ 3-space setup or in the general, 3-space it self?

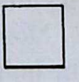
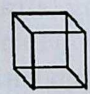
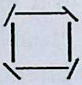
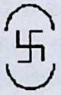
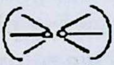
Hypercubes 4, 5, & 6

To answer the same let us mathematise this situation as:

Taking point as a representative regular body of 0 space, interval, square and cube respectively as representative regular bodies of 1, 2 & 3 space, we may conclude that moving 0-space (body) accepts 1-space format, moving 1-space (body) accepts 2-space format; moving 2-space body accepts 3-space format, and as a logical consequence the moving 3-space body shall be requiring 4-space format. And in general, moving n-space body shall be requiring (n+1) space format. For convenient handling.

We may define and designate four and higher dimensional bodies in continuation of interval, square and cube as hypercubes. To be precise hypercube 4 shall be a representative regular body of 5-space and so on. Further to facilitate comprehension of main properties of hypercube and for symbolic representation of the set of properties synthesizing hypercube it would be desirable to have suitable symbols for them, particularly for hypercube 4, 5 and 6 for reaching at the concepts and comprehension of multi-dimensional spacetime frame being availed for organization of the knowledge of Manasara.

Let these 3 special symbols of hypercube 4, 5 & 6 be as:

Interval	Square	Cube	Hypercube-4	Hypercube-5	Hypercube-6
					
1-space body	2-space body	3-space body	4-space body	5-space body	6-space body

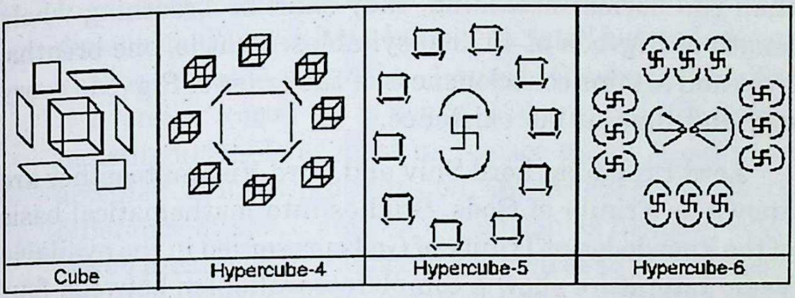
To have these symbols in continuity of the geometric setup of interval, square and cube, we have to first comprehend these geometric setups. As such, let us have a close look at the geometric setup of interval, square and cube. If we have close look at the geometric setup of interval, square and cube, we may comprehend that interval has length (A^1) and 2 boundary points ($2A^0$) Square has area (A^2) and 4 boundary line ($4A^1$) and cube has volume A^3 and 6 boundary surfaces ($6A^2$).

$A^1:2A^0$, $A^2:4A^1$ and $A^3.6A^2$ suggest a common formulation $A^n.2nAn^{-1}$, n=1, 2, 3.

This formulation would hold for all values of n. In particular, for n=4 5 & 6 we shall be getting $A^4:8A^3$, $A^5:10A^4$ and $A^6:12A^5$. The geometric message is that boundary of 4-

space body is constituted by 8 cubes while the boundary of 5-space body is constituted by 10 hypercubes-4 and so on.

The boundary components of interval, square, cube and hypercubes 4, 5 & 6 are in the ratio 2:4:6:8:12.This would help us comprehend, appreciate and have the symbols of hypercube 4, 5 & 6 in continuity of and in that sequential order, hypercube 4, 5 & 6 with boundaries as:



Shandchakra Format of Human Body

Further it would help us comprehend and appreciate the Upanishad knowledge regarding the Shadchakra format of human body as that:

अथ बहिर्लक्षणाम्। नासिकाकग्रे चतुर्भि षड्भिरष्टभि. दशभि. द्वादशभि. कमात्।

Here are being taken up the external structural characteristics (of shad chakras format of Human body) These with respect to the chakras (second to six) which are ahead of the tip of the nose (first chakra with two characteristics) are four, six, eight ten and twelve respectively, and in that order.

(Advet-tarko Upanishad)

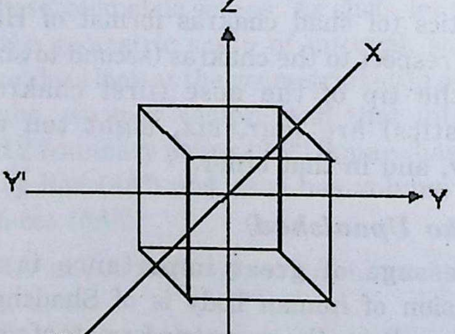
The message of great importance is that Vedic Comprehension of human body is of Shadchakra format which runs parallel to the geometric formats of representative bodies of first six spaces and hence this makes Purusha, the being of 6-space.

This will help us comprehend and appreciate the Vedic tradition which accepts Vedic Richas / Mantras as impulses of one's own consciousness. Here there is another aspect of our existence phenomenon. One breaths 21600 times a day. Equally one would breath 21600 times during night.

This makes day and night breathings as of 43200 units. Now those who do Pranayam (deep berating) 10 times deep than the normal breathing, they shall be breathing whole length of Rigveda of 432000 syllables. That is, one breaths, lives and attains consciousness of the order of Rigveda every day and nigh of his existence.

Lord Brahama, Lord Shiv and Lord Vishnu together are known as Trinity of Gods. Studies into mathematical basis of the knowledge of Trinity of Gods preserved in the available Vedic Literature show a complete parallelism between four heads of Lord Brahma and four dimensions of 4-space; five heads of Lord Shiv and five dimensions of 5-space; and six heads of incarnations of Lord Vishnu and six dimensions of 6-space. The detailed studies of idols of Trinity of Gods further take us to their geometric formats respectively being of hypercube 4, 5 & 6.

Dimensions and Spaces



Since our school mathematics, we draw three axes as depicted below as three dimensions of three dimensional frame of three dimensional space.

The message is that we are accepting line as a dimension of 3-space and as such three lines together constitute a three dimensional frame. This in fact is a particular case of general rule that (n-2) space plays the role of dimension of n-space. In modern mathematics as well mental constructs of higher dimensional spaces have been speculated but their dimension always remains a line i.e. 1-space. Obviously this concept is bound to recoil as it would make dimension and space indistinguishable at least in 1-space where 1-space is to be accepted as its own dimension. On the contrary, the rule of difference of space and its dimension as being of two units is well preserved in Ramayana as well as in Mahrabharatam. The narrations are that when the Arm of Lord Rama chased Kag-Bhushandi a difference remained only of two Anguls till Brahman-lok. Likewise when Mother Yashoda tried to tie child Krishna, She found that every string was short by two Anguls.

The great message is that the 'measures' for the measuring rod are bound to be of two units less. The Manasara, the scripture of Sathapatyaupved of Atharvved, accordingly accepts Lord Vishnu (six heads lord) as lord of measuring rod and Lord Brahma (four heads lord) as lord of measure. In geometric language it means that 4-space plays the role of dimension of 6-space.

Mythologically manifestations as idols, accepts head of the idol as format of dimension and eyes of the head together to synthesize a dimensional frame for the dimension.

Format of Idols

We may tabulate the following parallelism between the manifested idols of Trinity of Gods and the geometric set ups of hypercubes 4, 5 & 6 as geometric formats.

S.N.	Idol	Representative Geometric body
1	Number of heads	Number of dimensions of head
2	Head	Dimension of the space
3	Number of eyes in the head	Dimensional frame for the dimensions
4	Lotus (of 8 petals)	Hypercube-4
5	Lotus	Four space
6	Lotus seat	Hypercube-4 as domain
7	Lotus feet	Hypercube-4 as boundary
8	Lotus eye	Hypercube-4 as dimension

Upnishadic Enlightnment

Upanishads and Purans particularly Sri Sri Brahmpuran, Shivpuran and Vishnupuran enlighten us about Trinity of Gods as:

Lord Brahma : Lord Brahma is a four heads lord with two eyes in His each head. He sits majestically on a lotus seat of eight petals. He meditates on His lord (Lord Shiv) in heart and transcends to Shivlok where He multiplies Himself as ten Brahmas of four heads each.

The geometric message of the enlightenment can be decoded in terms of the following complete parallelism between the idol of Lord Brahma and geometric setup of Hypercube-4.

S.N.	Idol of Lord Brahma	Geometrical set up of hypercube-5
1	Four heads	Four dimensions
2	Two eyes	Spatial dimensions 2-space as dimension of 4-space
3	Eight petals	Eight solid boundary components (A4:8A3)
4	Heart	Origin / Centre
5	Lord of Lord Brahma	5-space as origin of 4-space
6	Ten Brahmas	10 hypercubes-4 as boundary of hypercube-5 (A5:10A4)

(Dr. Dharmesh Shukla has worked out the details in his doctoral thesis titled "Some properties of real 4-space in the light of Vedic knowledge accepted (1994) by H.N. Bahuguna University, Uttar Pradesh).

Lord Shiv: Lord Shiv is a five heads lord with three eyes in His each head. He has ten beautiful arms. Sri Sri Shiv Mahanpuran enlightens us that Hanumanji is incarnation of Lord Shiv. Ramayana enlightens us that Lord Rama, the incarnation of Lord Vishnu, resides in the heart of Hanumanji.

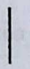
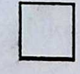
The geometric message of this enlightenment can be decoded in terms of the following complete parallelism between the idol of Lord Shiv and geometric setup of Hypercubes-5.

S.N.	Idol of Lord Shiv	Geometrical set up of hypercube-5
1	Five heads	Five dimensions
2	Three eyes	Solid dimensions / 3-space as dimension of 5-space
3	Ten arms	Ten hypersolid boundary components (A5:10A4)
4	Heart	Origin / Centre
5	Lord of Lord Shiv	6-space as origin of 5-space
6	Dwadas Adityas	12 hypercubes-5 as (12 Suns) boundary of hypercube-6 (A6:12A5)

The Thesis of Sh. Bidyadhar Panda titled "Some Properties of real five space in the light of Vedic knowledge works out the details of geometric seup of hypercube 5 and real 5 space of Vedic Comprehension and establishes Sri Sri Shiv Mahapuran as text book of real 5 space. These two these deserve to be published for research scholars.

Manifestation Layers

In the light of the above, if we may have a fresh look at the geometric set up of a cube. We shall be noticing that the 3-space content/lump manifesting as "volume" of the cube is wrapped within 2-space surface (2-space content/ sheets). Further, we know that this is the organization which admits linear dimensional order i.e. 1-space in the role of dimension. Now, if we concentrate upon the centre of the cube, we shall be noticing that 8 sub-cube are synthesized as a cube. We may view centre of the cube as being wrapped within 8 cubes. This is parallel to the cut of 3-space by dimensional frame into 8 octants. As such, the formulation A4:8A3 of hypercube-4 being availed by Lord Brahma to manifest as an idol would help us comprehend that at centre of the cube like at the origin of the 3 dimensional frame is sealed 4-space.

Manifestation Layers			
First Fold	Second Fold	Third Fold	Fourth Fold
Dimension Part	Frame Part	Domain Part	Origin Part
			4-space

The origin/centre, the domain/volume, the boundary/ surface and linear dimension of cube are four distinct folds of four distinct spaces which together synthesis and manifest geometric setup of a cube. Therefore, the great geometric message is that our physical workd/3-space/cube/macro world is the first manifestation layer with 1-space playing the role of dimension, 2 -pace playing the role of boundary, 3-space playing the role of domain and 4-space playing the role of origin.

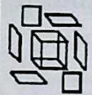
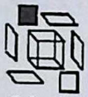
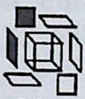
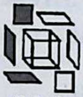
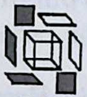
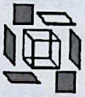
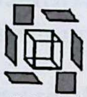
Likewise, the world of Lord Brahma i.e. the real 4-space, is the micro world manifestation layer of second order as 2-space plays the role of dimension, 3-space plays the role of boundary, 4-space plays the role of domain and 5-space plays the role of origin. In general, the manifestation layer of order n shall be accepting n-space in the role of dimension and (n+3) space in the role of origin.

The Lord Brahma, the Creator of Supreme, creates reality as manifestation layer of 4 consecutive spaces synthesizing together. This creation accepts origin in a sealed state. It is a dormant state. The transcendence from one manifestation layer to another manifestation layer requires unlocking of the seal of origin fold. This as such becomes possible only on 5-space format. Therefore, Lord Shiv, the transformer the Supreme, is the Lord of transcendence. Accordingly, in Shivlok exists vibrant synthetic setup of 5 folds where transcendence from manifestation layer to another manifestation layer becomes possible.

Vibrant Synthetic Reality

Vedic Model of vibrant synthetic reality of 5-space format is a multi-dimensional format of space and time. It takes account of transcendence through manifestation layers as flux of time. The transition from spatial dimensional order to the solid dimensional order is worked out as a flux of time of 4-space reality which takes us to 5-space reality. In concrete terms, the dimensional order of manifested world being spatial, it attains transition in terms of solid dimensional order of time, being of solid dimensional order. The time flux crystallizes as a tri-monad i.e. the dimensional constituent i.e. monads as of three parts. This tri-monad format of time when supplied to the manifested bodies of the manifestation layers, it works out (2n+1) versions of the manifested bodies. In geometric language, it simply means that the interval, square, cube and hypercube, as representative regular bodies of the respective dimensional space, in the roles of domain fold of respective manifestation layers, shall be accepting (2n+1) versions or in other words, (2n+1) geometries.

Illustratively for n=1, we shall be having 3 geometries of 1-space or in other words, we shall be having 3 versions of an interval designated as close interval, half-open interval and open interval. These versions of intervals are having common domain (length) and they differ only in terms of the boundary components (points). Close interval accepts 2 boundary points, while half-open interval accepts one boundary component and open interval is devoid of both the boundary points. For n=2, we shall be having 5 geometries of 2-space or in other words, we shall be having 5 version of a square in terms, of 4, 3, 2, 1 & 0 boundary lines and for n=3, we shall be having 7 geometries / versions of 3 space/ cube in terms of 6, 5, 4, 3, 2, 1, 0 surface plates and so on.

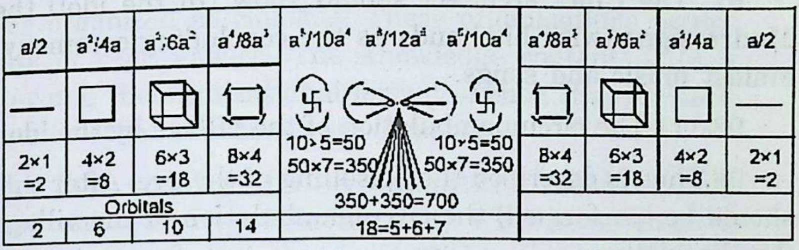
Seven Geometries						
Geometry-1	Geometry-2	Geometry-3	Geometry-4	Geometry-5	Geometry-6	Geometry-7
 G 3, -3	 G 3, -2	 G 3, -1	 G 3, 0	 G 3, 1	 G 3, 2	 G 3, 3

In 3-space, we shall be having 1-space as dimension. The flux of time would be of spatial order. 2-space admits 5 geometries. The 3 dimensions plus 5 versions would give us 3 + 5=8 order. In terms of it, we shall be attaining 8 = 2 × 4, i.e., 4 spatial dimensions which shall be constituting dimensional order of 4-space. This is how the spatial time flux shall be working out transition from linear dimensional order / space i.e. 3-space to spatial dimensional order / space, i.e., 4-space. Likewise, in 4-space, we shall be having 2-space as dimension and 3-space as flux of time. 3-space admits 7 versions. The dimensional order of 3-space admits 7 versions. The dimensional order of 4-space would yield 2 × 4 order. This 2 × 4 order plus 7 versions shall be yielding 8 + 7 = 15 order. In terms of it we shall be attaining 15 = 3 × 5, i.e., 5 solid dimensions which shall be constituting dimensional order of 5-space. This is how the solid time flux shall be working out transition from spatial dimensional order space, i.e., 4-space to solid dimensional order space, i.e., 5-space.

Therefore for proper appreciation of vibrant synthetic reality of Vedic comprehension, we have to work out the

Vedic Knowledge, the Vedic way. The geometric continuum is at play around us. The organizational format of Srimad Bhagwad Gita, the eternal song of Lord Krishna, makes complete use of real 6-space. This may be depicted as study-zone of Srimad Bhagwad Gita as under:

Srimad Bhagwad Gita
Study Zone



$a/2$	$a^2/4a$	$a^3/6a^2$	$a^4/8a^3$	$a^5/10a^4$ $a^6/12a^5$ $a^5/10a^4$	$a^4/8a^3$	$a^3/6a^2$	$a^2/4a$	$a/2$
2×1 =2	4×2 =8	6×3 =18	8×4 =32	10×5=50 50×7=350 10×5=50 50×7=350	8×4 =32	6×3 =18	4×2 =8	2×1 =2
Orbitals				350+350=700				
2	6	10	14	18=5+6+7				

The organization of Manasara runs parallet to the study zone of Srimad Bhagwad Gita. This also runs parallel to the Shad Chakra format of Human body. The organizational format of nucleus of the nucleus as well avails this zone where Jyoti flows from core of the sun into the core of the Sanatana base as 7 streams. This flow is channelised on Om Formulation of 4 components as a Divya Ganga flow. This is a complete discipline in itself. At present we may not be in a position to enter into the details of this Vedic discipline of channelization into the Sanatana base but it may not be out of context to make a mention that advanced students of Vedic Science and Technology have to learn about it.

Organisation of Manasara

Prayer of Lord Brahma to Chiselling of Eye of Lord Shiva

Opening Prayer of Lord Brahma

He (Brahma), while causing the creation, the preservation, and the destruction of the worlds, brings forth earth, water, fire, air, and the sky. I bow to (His) lotus-like feet kissed by the waving lines of bee-like crowns of the kings of various gods. (Manasara Chapter-1 Shaloka 2)

The Chiselling of the Eye

1-2 the chiselling of the eye of the (idols of the) gods, goddesses, and devotees, and the purification (cleansing) of the phalli (of Shiva) will be described in order of the subject.

3-96 ....

97. The Chief architect should show (to the idol) the Mudra signs (with his hands as the concluding ceremony) amidst music and songs.

98-111 The circumambulation of the village by the idol.

98.Thus is described the chiselling of the eye. After this should be (performed) the circumambulation of the village (by the idol).

99-114 ....

115-118. This great science (of architecture) was at first revealed by Brahma, Indra, and all other gods: It is from their statements that this Manasara (the essence of measurement) has been complied as a guide book (for the architects) for the benefit of the people.

Thus in the Manasara, the science of architecture, the seventieth chapter, entitled.

The description of the chiselling of the eye (of image). The Manasara is complete.

Sri Shri Shiva Mahapuran

Lord Shiva is the overlord of real 5-space. Sri Sri Shiva Mahapuran is a text book of real 5-space. The organizational format of Sri Sri Shiva Mahanpuran is the organizational format of real 5-space. The scripture is organized as Samhitas parallel to 7 dimensions of 7-space.

5-space plays the role of dimension of 7-space and as such each of the 7 Samhitas of Sri Sri Shiva Mahanpuran enlightens us about one or the other aspect of the knowledge of real 5-space in the role of dimension.

These 7 Samhitas are organized as 12 parts. This is parallel to 12 boundary components of real 6-space. Each boundary component of real 6-space is a 5-space set up. Therefore, these 12 parts are the organisation of 7 Samhitas of Sri Sri Shiva Mahapuran as boundary of 6-space.

The 7 Samhitas of Sri Sri Mahapuran consisting of 12 parts are further organised as chapters and chapters are further organised as Shlokas. These organisations accept formats of real 5-space. The knowledge content of each chapter and the orgnizational format of each chapter work out one or other aspect of real 5-space.

The first chapter of first Samhita of Sri Sri Shiva Mahapuran posses a question as (that): What is the shortest way to salvation? And the great Rishi remembers Lord Shiva and gets prepared for answering the same. This that way would help us comprehend and appreciate that the question being posed and the answer which is going to follow is to be about Lord Shiva.

The manifestation which is being talked to be transcended through is the manifestation of real 4-space. As such the first chapter of the first Samhlta takes us to the format of hypercube-4 with a sealed origin. The great concern being shown by the sages (Munis) to the great Rishi is about the spatial nature of the setup of 4-space and the question being raised is how this manifestation can be transcended through.

Naturally, the great Rishi concentrates upon the origin and prepares for answering the question by remembering Lord Shiva. Who is the overlord or real 5-space playing the role of origin and remaining in dormant state in the sealed origin. Therefore, content-wise, Shi Sri Shiva Mahapuran beings with the geometric format of hypercube-4 with sealed origin. Likewise, the Manasara opens with the prayer to Lord Brahma and ends with the chiselling of an eye with which the seal of the origin would be unlocked and transcendence would take place and the 5-space coming into play and 4-space content resoling back to the boundary of 5-space. The knowledge content of Sri Sri Shiva Mahapuran deserves to be imbibed by all the students of mathematics, science and technology of Vedic Order. Sri Sri Shiva Mahapuran is a complete course in itself and it may not be possible to go into details at present.

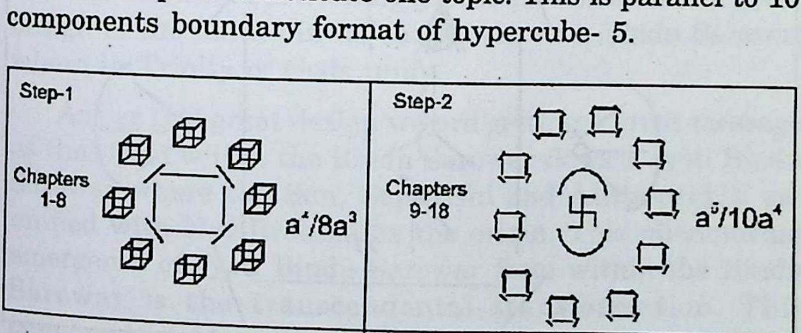
Organizational Format of Manasara

The great design of nature is imprinted in each grain of Nature. Vedic Comprehension of this design conceptualises as Bindu "Sarowar". This grand unification of Trinity of Gods in each point reservoir of nature (Bindu Sarowar) may be viewed as the Trinity of Gods as first three folds and their unification as the fourth fold. In concrete terms, this amounts to 4-space playing the role of dimension for the organisational format of the great design of Bindu Sarowar and 5-space playing the role of boundary there of and 6-space manifesting as their domain fold and 7-space as origin thereof.

It is this grand design which is availed by the Vedic scriptures to organise the pure knowledge. The aim of Manasara as well is to avail this grand design of nature. The 7-space flows as 7 streams of Divya Ganga from core of the Sun; the sun being the body of 6-space and its core being the 7-space as origin of 6-space. The Divya Ganga flow from core of the sun (6-space) takes to the Sanatana base (5-space in the role of boundary of 6-space). Being vibrant synthetic reality this flow is going to be of vibrant and synthetic as reality. It is going to be of two parts. Accordingly, the Jyoti flowing from core of the Sun shall be flowing into the Sanantna base on either side of the Sun. This would help us appreciate and comprehend the Jyoti flow of 7 streams into Sanatana base (5-space) as of 7 × 5 =35 units on either side of the Sun and thereby we shall be having the flow rate of 35 + 35 = 70 units. It is this flow rate which runs parallel to the first organisation of the knowledge of Manasara as of 70 chapters.

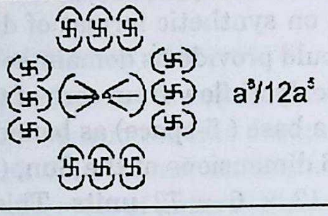
The whole range of organization of 70 chapters is in fact the organization of the great design of the Bindu Sarowar. This range with definite end points shall be making it a close range of 1 + 70 + 1 = 72 units. This would completely wrap 6-space within 5-space boundary. With the help of the geometric set up of hypercube-6 as representative body of real 6-space on synthetic format of di-monad i.e. monad of two parts would provide us domain-boundary ratio A6:12A5. The complete Jyoti flow from core of the Sun (6-space) into the Sanatana base (5-space) as boundary of 12 components as through 6 dimensions of the Sun, (this flow) would be at the rate of 12 × 6 = 72 units. This also would help us comprehend and appreciate the sequential state of the this organization in the sequential order of 2 × 1, 2 × 2, 6 × 3, 8 × 4, 10 × 5 & 12 × 6 of the atomic organization. In fact this six steps long sequential order would take us uptill the nucleus of the nucleus of the atom. This also would help us comprehend and appreciate the Manasara accepting Lord Vishnu, the lord of 6-space as the god of the measuring-rod.

Now if we have a close look at the subject matter of the 70 chapters of Manasara, we shall be noticing that first 8 chapters constitute one topic. This is parallel to the boundary of hypercube-4 being of 8 components. Therefore the organizational format of the first 8 chapters of Mansara is the format of 8 components of boundary of hypercube 4. The next 10 chapters constitute one topic. This is parallel to 10 components boundary format of hypercube- 5.



The next set of 12 chapters i.e. chapter 19 to 30 topically take up one story building to 12 storied building. This is parallel to the 12 components boundary of hypercube-6. With this we shall be reaching the state where we have to tap the Jyoti flow from the core of the Sun.

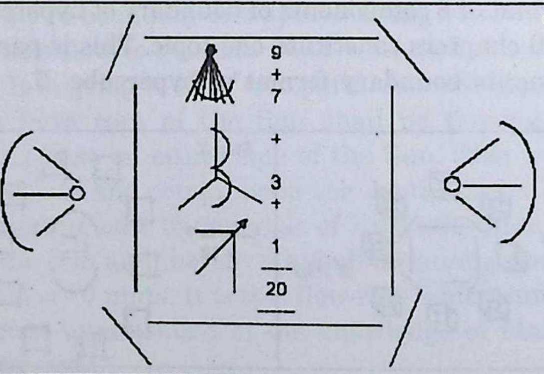
Step-3



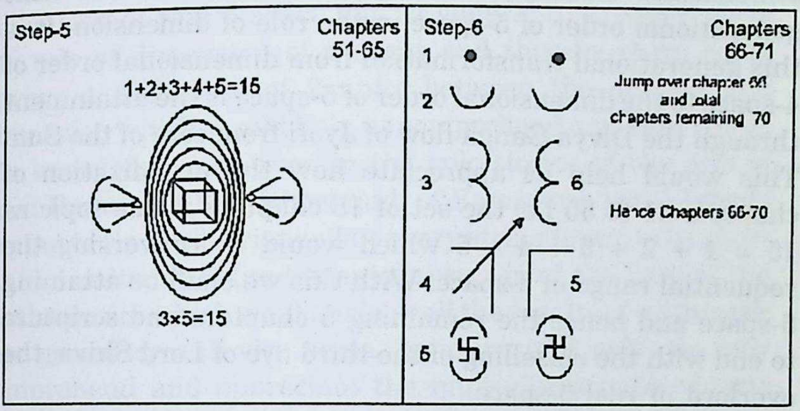
The Sun is a body of 6-space. Six space in the role of dimension shall be taking us uptill 9-space in the role of origin. In fact this Jyoti Bindu flowing from the core of the Sun is accepting 6-space (Sun) as dimension, 7-space (Saptrishi) as boundary, 8-space (Asht-prakriti) as domain and 9-space (Nav Brahm) as origin. This 4 folds Jyoti Bindu flow is the Divya Ganga flow of 4 folds. Jyoti Bindu flow is the Divya Ganga flow of 4 folds on the format of OM as formulation of 4 components, first as the Bindu Sarowar of Nav-Brahma as of 9 units, the second component of Ardha-Matra as of 7 units, the third component as Tri-Pundarm of 3 units and fourth component as Swastik Pada as of 1 unit. Total being of 20 units.

Step-4

Chapters 31-50



And these 20 units flow would be on either side and as such we shall be having 20+20 = 40 unit flow which shall be covering the remaining range of 40 chapters. Topically the 20 chapters from chapter 31 to 70 would be completing one topic. The organization of the remaining 20 chapters would get a division, in the context of Manasara as of 15 chapter and 5 chapters.



I have worked out the details of organizational format of Manasara as 138 graphics as separate compilation under Vedic Geometrical Series as a treatise for Indian Institute of Mahraishi Vedic Science & Technology. These graphic plates of the organizational format of the Manasara take up the organization right uptil the verses and even subverses of each chapter. Of these, I am using them now to illustrate how the Manasara is availing geometric format of the great design of the nature in its each grain as a Bindu Sarowar where in Trinity of Gods unify.

As per this great design we are getting a great message as that from within the Bindu Sarowar flows a Jyoti Bindu Sarowar where the Sun, Sapt-rishi and Ashta-prakiti get unified with Nav-Brahma as the origin. This phenomenal emergence of Jyoti Bindu Sarowar from within the Bindu Sarowar is the transcendental transformation. This transcendental transformation phenomenon is at work which helps sequential attainment of consciousness state. Also this transcendental transformation phenomenon is at work which takes us from seed to the tree and tree to the seed as a life-span and a sequential generational flow.

The Jyoti flows from the core of the Sun into the Sanatana base at boundary of the Sun potentialised the 'boundary space' to play the dimensional role. With this 4-space dimensional order of the Sun transforms into the next generational order of 5-space in the role of dimension. It is this generational transformation from dimensional order of 4-space to the dimensional order of 5-space is the attainment through the Divya Ganga flow of Jyoti from core of the Sun. This would help us appreciate how the organization of chapters 51 to 55 i.e. the set of 15 chapters is one topic as 15 = 1 + 2 + 3 + 4 + 5 which would be conversing the sequential range of 5-space. With this we shall be attaining 5-space and hence the remaining 5 chapters and scripture to end with the chiselling of the third eye of Lord Shiva, the overlord of real 5-space.

Measures and Measuring-rod

The concept of measures and measuring-rod of Manasara is of central importance. In fact Mana means measure and Sara means essence and as such Manasara means essence of measures. The science of Architecture and Sculpture centres around the essence of measures and the exactness of the measuring-rod. Therefore, the relevant knowledge of measures and measuring rod of chapter 2 Manasara deserve to be read thoroughly.

The verses 64 & 65 describe the measuring-rod as that: Measuring-rod should be one cubic long, one anguls (three fourth inch) broad, and its thickness is stated to be a half Angul. The yard-stick (lit, cubic measure) should be accurately marked.

The verse 68 enlightens us that: Vishnu is stated to be the tutelary god of (the wood for) both the yard-stick and the (measuring) rod.

Further, verse 75 enlightens us that: Vasuki (serpent-god) is the presiding deity of the (measuring) rope, and Brahma is known as the presiding deity of measurement.

Lord Brahma is a 4 head lord. Lord Vishnu is a 6 head lord,. Lord Brahma is born from the lotus whose reed springs from navel of Lord Vishnu. This Puranic comprehension is the Vedic enlightenment of real 4 space playing the role of dimension of real 6 space and in general (n-2) space plays the role of dimension of n space and thereby there being always a difference of 2 units between the domain and dimension which would help us comprehend and appreciate, the knowledge preserved in the epic stories of the arm of Lord Rama and Kag-Bhushandi of Ramayana and Yashoda Trying to tie Lord Krishna but every string found to be short by two units. This fundamental result is at the base of the mathematics which would help avail the results of arithmetic into geometry and vice versa. In terms of it only, we may comprehend and appreciate the multi-dimensions of time and space of Manasara as well as of other Vedic Scriptures.

4

Practical Application of Vedic Mathematics

Vedic Mathematics has Certain Visual Solutions which could be Applied in Problem Solving

There are 16 known sutras or axioms in vedic mathematics, some of which provide 'visual' mathematical solutions or solutions using mental techniques. It is perhaps possible to make practical use of these sutras in certain situations. Particularly where data or information validation can be done by using the appearance of 'zero' or nil values in any data set. Situations, where data, information or records are destroyed or lost, by accident or fraud, provide a natural camouflage for all kinds of manipulations. Plenty of insurance claims are known to have been inflated by altering data. For example, in case of an insurance claim for 'loss of profit' where a business has been disrupted by fire, the claimant will try and inflate past sales and profit figures to maximise his deemed profit for the claim.

Further, in most of these cases, the claimant can always express his inability to provide sufficient evidence to back his claim, using the 'destruction of records' as an excuse even though the evidence actually may not be even partially destroyed. In these situations, sometimes unconventional or unknown researched techniques could prove more effective.

Tests of 'reasonableness' using human judgement are the only tools which may be applied to ferret out inaccuracies and even deceptions. In such circumstances, perhaps Vedic mathematics might offer considerable assistance. Take the case of the following information given to an insurance company for a claim for 'loss of profits' on account of a fire and disruption of activities, where machines, stocks and several records were destroyed by fire. The company had two products in stock. Each product was packed and dispatched in boxes with standardised, precise weights. The claimant provided information of status of stocks and dispatches as given below in the two tables to support his claim for loss of profits:

Table A: Statement of Inventories (boxes of stocks as endorsed by third parties' confirmations:

Third Parties confirming the inventory quantities	VERIFICATION DATE	PRODUCT A (Quantities in boxes)	PRODUCT B (Quantities in boxes)
Auditors year end verification	March 31	74	126
Bankers hypothecated stock verification	May 31	67	113
Stock lost on date of fire	June 30	54	98

On account of seasonal trends there was no production of A and B in the above period. Therefore all changes in figures related to sales and dispatches only. Accordingly sales were as follows.

Table B: Statement of Sales Dispatches of Boxes in the post verification periods per Table A

Event	Period	Dispatches-product A	Dispatches-product B
After Auditor's verification	March 31-May 31	7	13
After Banker's verification	May 31- June 30	13	15

These dispatches were critical from the point of view of quantifying sales and determining profits claimed to have been lost because of the fire. The sales registers supported this statement also. However, the surveyors requested an accountant who was also a certified fraud examiner to give his assessment. The accountant reviewed the relevant data and found that these boxes were transported or shipped by professional container lorries. These transporters furnished details of the number of boxes, destinations and the time and date of delivery. Using these lorry receipts, the accountant painstakingly totalled the weights of all boxes transported during the two periods in table B above. He found that the total weights dispatched were 10.5 tonnes and 19.5 tonnes respectively. This is where he remembered vedic mathematics, the sutra 'Anurupye Shunyam anayat'. In simple words, in simultaneous equations, if the ratio of the co-efficients of one of the variables is in exact proportion as the constants, then the other variable is 0. Thus in the above case, if the weights of the boxes for products A and B were taken as x and y respectively, the dispatches, in terms of weight, could be represented as the following simultaneous equations:

$$7x + 13y = 10.5$$

$$13x + 15y = 19.5$$

144580

The ratio of the coefficients of x is 7:13 proportionate to the ratio of the constants 10.5: 19.5 or 1.5*7:1.5*13 This implied that y=0, which further meant that dispatches of product y were of weight 0 or, in other words, there were no dispatches of product y. The accountant then inquired into the actual weights of boxes from external sources and he found that the weights of the boxes were in fact standardised at 1.5 tonnes and 2 tonnes for products A and B which confirmed the result of the above equations. On launching an investigation it was found that the sales bills for product B were to sister concerns and in fact fictitious. Since product B had a high margin of profits, the claimant was tempted to inflate profits by showing sales of product

B also, though there were none. The bankers stock statements showed lesser stocks because they counted only those which were hypothecated, as they were concerned with the stocks required to cover their loan and margin requirements. In fact it was also learnt that the stock of product B was in a bad condition and unsaleable. The company was in a bad shape financially and therefore had resorted to such means of falsification. However, applying visual application of vedic mathematics it was possible to prove the claim false.

This illustration does not seek to establish that solutions cannot be found by other means. It emphasizes on the simplicity of the tenets of the sutras of vedic mathematics. Perhaps research and intensive study of vedic scriptures might reveal even more advanced applications. What is illustrated above is a very elementary application of the sutra. The depth and richness of the vedic knowledge is beyond description. Greater research and more teamwork in sharing of ideas and interpretation may provide revolutionary results.

Vedic Re-establishment

Vedas, the most ancient Indian Scriptures or the oldest scriptures of the whole world, deal with all branches of learning; either spiritual, or temporal and are capable to give the knowledge of each and every technology, being used today.

The word 'Veda' means 'the fountain head' or 'the store house of knowledge', being sustained by the speak-learning process of ancient Indian Gurukuls. The ancient Indian Vedic Knowledge is all round complete and perfect and able to throw the necessary light on all matters of the MODERN AGE. The treasure of Vedas & Vedangas include (1) Ayurveda (Physiology, Anatomy, Hygiene, Sanitary Science, surgery, Medical Science, etc.), (2) DhanuVeda (Archery and other Military Sciences), (3) Gandharva Veda (the Science of Art of music), (4) Sthapatya Veda (Enginnering, Architecture etc., and all branches of Mathematics), (5) Rasayanam (Chemistry), (6) Bhautiki (Physics), (7) Jeevanam (Biology), (8) Ganit (Mathematics), etc., and the Vedangas include (a) Grammer, (b) Prosody, (c) Astronomy, (d) Lexicography. There were many reasons for our quest for discovering and researching on all the departments, branches and sub-branches of Vedas.

It was a deepest intensive legacy of our sages & scientists which provided the ethics, psychology, metaphysics on one hand to us and the pure and applied sciences and mathematics on the other. And when we would read or hear the so-called Orientalists, Indologists, Antiquarians, research-scholars, who condemned irresponsibly for the Vedas as "Superstitious-Nonsence". These taunts added fuel to the fire ignited in our minds and as it spread, the darkness vanished the path of re-establishment of the true Bhartiya knowledge became clear to us. And then we made our mind to unzip the wealth hidden in the ancient texts and to open the hidden mysteries of science, philosophy & mathematics of Vedas. After a deep intensive research, the Research Wing of Samkranti (Shodh Vahini) is in front of you with concentrated wealth of Ancient Advanced Technified Bharat and are capable to recover the lost keys which alone can unlock the secrets of all the affairs of life and spirituality.

You will be surprised to know that extremely tough mathematical problems which the modern mathematical rules find hard to solve, can be easily and readily solved with the help of ULTRA EASY VEDIC SUTRAS contained in the Appendix (Parishishta) portion of the ATHARVA VEDA in a few steps which do not require more calculation work. We are planning to carry the campaign of this VEDIC KNOWLEDGE to the India by means of Schools, Colleges, Universities, Lectures, Seminars, Vocational and Full time Courses.

The Vedic Sutras cover each and every part of each and every topic of each and every branch of Mathematics including Arithmetics, Algebra, Trigonometry - plane & spherical, Conics - Geometrical and Analytical, Geometry - plane and solid, Astrology, Calculus - Differential and Integral, etc. There is no part of Mathematics, which is beyond the grip of Vedas. As compared to the modern western mathematical methods, the methods based on Vedic Sutras take a third, a fourth or even a much smaller fraction of time. And amazingly, the sums requiring 50, 80 or 100 or even more steps can be answered in simple or even single steps by Vedic Methods.

A lot of seminars are conducted on this mathematics and the doctors, professors, and the "Big Bosses" of mathematics are wonder struck. Interest in the Vedic system is growing and the mathematics teachers are looking for something better, something more precise, more accurate and the Vedic Mathematics is the final solution for them. Researches are being carried out in the effects of learning Vedic Maths on children, and we, the Research Panel (Shodh Vahini) of SAMKRANTI and the Faculty of Vedic Research Institute, are trying to develop new, powerful, accurate, but easy applications of Vedic Sutras in Mathematics. But the real advantage, beauty and effectiveness of Vedic Mathematics can not be fully understood without actually practicing the system. Try it, and see that it is the most refined and efficient Mathematical and Computational System ever possible. The main Sutras revealed in Vedic Mathematics are like :

By one more then one before.
All from nine and last from ten.
Vertically and crosswise.
Transpose and apply.
If the Sammucchya is same, it is Zero.

If one is in the Ratio, the other is Zero.

By addition and by subtraction.

By completion and non-completion.

Differential Calculus.

By the Deficiency.

Specific and General.

The remainders by the last digit.

The Ultimate and twice the Penultimate.

By one less then one before.

The Product of Sum.

All the Multiples.

The Sub-Sutras :

Propositionality.

The Remainder Remains constant.

The first by the first, and the last by the last.

For seven, the Multiplicant is 143.

By Osculation.

Lessen by deficiency.

Whatever the deficiency, lessen by that amount and set up the square of deficiency.

Last totalling 10.

Only the last terms.

The sum of the products.

By alternative elimination and reduction.

By mere observations.

The product of sum is sum of products.

On the Flag.

Our organization is researching on the Sutras deeply and making a pure Indian Mathematical 10 year syllabus to be taught in Indian Schools.

Vedic Cognitive Sciences

SAMKRANTI plans to make a syllabus from the Cognitive sciences of Vedas for every class including all the useful chapters of Vedas, Upanishadas and Darshans. Let us take some illustrations; Rigveda Speaks of Cosmic Order. It reveals some links and equivalence between outer and inner worlds. The Vedic vision tells that Material and Conscious are aspects of same transcendental reality. The Vedangas caution the ultimate knowledge groups like 1. Logic, 2. Physics, 3. Cosmology, 4. Psychology, 5. Language, 6. Reality.

The super latest technologies that are being used and studied in the world arose in India, several centuries before their re-discovery in the West. We have written proofs for this, the MAHABHARAT mentions EMBRYO-TRANSPLANTATION, MULTIPLE BIRTHS from same fetus, Battles with Extra Terrestrials who are wearing Air-Tight suits and weapons of Mass Destruction. RAMAYAN mentions Air-Travel. SHRIMADBHAGWAT and BRAHMAPURAAN has incidence related to different passage of time for different observers and of reality. YOG VASHISHTH, YOG RAHASYAM, YOG SUTRAM and TRIPURA-RAHASYAM give the deep knowledge of nature of Consciousness. We find examples of accurate Astronomical numbers in early texts. The accuracy was perfectly based on the Biological Cycles that reflect Astronomical process like Menses according to the period of moon. I recall one of my favourite quote, "Yatha pindey, tatha Brahmaandey" that means, we can understand the outer existence by the understanding of inner. In the Tetteriya Upanishad, an individual is represented in terms of five different sheaths or levels. The SANKHYA and YOG explain the mind as consisting of five components: Manas, Ahamkaar, Chitta, Buddhi, Atman. Manas is the lower part of mind and collects sensory imressions. This sensory motor mind obtains its inputs from the senses of hearing, touch, sight, taste, smell. The Ahamkaar is the sense of I-ness that has some perceptions to a subjective and personal experiences related to the I-ness. By Ahamkaar, their decisions, evaluations and results are expressed by the intellect that is Buddhi. The Manas, Ahamkaar and Buddhi collectively called Mind and the memory bank of this Mind is Chitta. And the innermost aspect of consciousness is called Atman, Jiva, Brahma. Read the Brahmavaivarta Puraan. In the incident of Indra and Ants, Sri Vishnu in the guise of a boy tells Indra that these Ants have been Indras in their own Solar systems in different times. This is an excellent example of the knowledge of Solar System and Universe in Indian Literatures. Aryabhatta, born in 476 is auther of Aryabhattiyam, a most prestegious book on Mathematics and computing science. In the book, he covers Mathematics, cosmic and planetary theories. The book is divided into four chapters.

Astronomical Constant and Sine table.

Mathematics for computation.

Division of Time, rule for computing the Longitudes of planets using eccentrics and epicycles.

The armillary Sphere, rules relating problems of Trignometry and computation of Eclipse.

Aryabhatta Explains Earth to spin on its axis. He also considered the heavenly motions to go through a cycle of 4.32 Billion Years. He was also well aware of relativity of motion as he writes, "Just as a man in a boat sees the trees on the bank move in the opposite direction, so and observer on equator sees the stationary stars as moving precisely towards west." Brahmagupta contributed to the solution of a certain indeterminate equation. Bhasker (born in 1114) wrote Siddhanta Shiromani, a book containing four part:

Lilavati, based on Arithmetic.

Beej Ganit, on Algebra.

Ganitadhyaya.

Goladhyaya, on astronomy.

Madhava (1340- 1425) developed a procedure to determine the position every 36 minutes. He also gave power series expansions for Trignometric Functions and for Pi correct to 11 decimal places.

So much wealth Indian Pure Science and Mathematics have. The foreigners are still getting the advantage by their clavery. When the Vedic in a well practise in India, it was discouraged and suppressed trickfully and they renamed the terminologies and pretended to discover the existing laws as some new ones. Now, when people cowardishly accepted western impure science, they riturn back to the Gyan given by VISHVA GURU BHARAT. The Maharishi School in Lankashire has developed a course on Vedic Mathematics that covers the National Curriculum. There are lots of such examples about awaking of the foreign eyes towards the essence of Vedic Studies, but we, the owners of this uncomparable knowledge, are ignoring it for long. We ourself are making fortune in trouble.

In the Vedic times, the records of Mathematical Activities are found in Vedic Literature. During the redistribution of land of farms, the problem of Mensuration came, which were accurately solved at that time. The Taxation System at that time were based on fixed proportions of Annual or seasonal crop-incomes. Mathematics was given considerable importance in Vedic period. The Vedanga Jyotish says, "Just as the feathers of a peacock and the jewel stone of a snake are placed at the highest point of the body, similarly the position of Ganit (mathematics) is the highest amongst all the branches of the Vedangas and Shastras.

Re-establishment

Veda—The constitution of the Universe

HH Maharishi Mahesh Yogi says, " Veda is the Self referral dynamism of the transcendental field of pure subjectivity which is the transcendental basis of creation and its orderly administration through NATURAL LAW.

EVERYTHING IS MADE OF VEDAS - TOTAL NATURAL LAW. EVERYTHING IS VEDIC. EVERYONE IS VEDIC. SINCE EVERYTHING IS VEDIC, EVERYTHING SHOULD BE WHAT IT IS."

India in the ancient times established a perfect, a pure government - RAMRAJYA, heaven on earth by strengthening higher intelligence. This higher intelligence can be re-achieved through Vedas only. Thus, the Vedic Re-establishment project of SAMKRANTI contains :

- The Vedic Culture Practice to culture the life and for enlightenment of life.
- The Vedic Education that will give the real, true knowledge to the world.
- The Vedic Health that is without side-effects and is totally natural.
- The Vedic Defense that contains the research on 'Vedic Kavachs Stotras and Paaths' that check the evolution of any enemy and give a super sysmetic power of nature.
- The Vedic Agriculture that controls the qualities of soil, seed, water, and the menures and strengthens the intellect of farmers.
- The Vedic Economy, that uses the National resources and money in the best possible way.
- The Vedic Architecture that constructs the houses, cities, villages in the perfect way and thus constructs the Nation.

5

Applications of Vedic Mathematics

The most notable application of Vedic mathematics is in education. Vedic mathematical strategies may prove to be a useful resource for teachers and students, who may find elements of it easier and more accessible to teach and learn than conventional mathematics. In particular, these strategies may be an invaluable resource to students that already struggle with mathematics, and could benefit from alternative approaches.

One attempt at incorporating Vedic mathematics into education was made by Mark Gaskell, the head of mathematics at the Maharishi School Lancashire, England (Gaskell, 2000). The school has developed a Vedic mathematics curriculum equivalent to the national one with impressive results. According to Gaskell, the alternative curriculum has resulted in livelier classes, greater student enjoyment and understanding, and improved academic performance (2000). In fact, the first set of students to complete the course were each able to not only pass, but achieve over 80%, on the General Certificate of Secondary Education, a proficiency test taken by all secondary school British students, a year earlier than their peers in the regular curriculum (2000). If harnessed appropriately, there seems to be great potential for how Vedic mathematics can be used to teach, learn and understand mathematics. Perhaps the most important aspect of including Vedic mathematics in an education system will be taking the step towards becoming open to conceptually different mathematical approaches—approaches that could one day free and transform mathematics education.

Controversy and Criticism

There has been much controversy amongst Indian scholars about Tirthaji's claims that the mathematics is Vedic and that it encompasses all aspects of mathematics (Kansara, 1961). First, Tirthaji's description of the mathematics as Vedic is most commonly criticised on the basis that, thus far, none of the sutras can be found in any extant Vedic literature (Williams, 2000). However, trying to locate the Tirthaji's references in the Vedic literature would be extremely difficult; the Vedas are too large for a complete translation, and are composed in an obscure and complicated ancient dialect (Kansara, 1961). Furthermore, it is also possible that Tirthaji rediscovered and reconstructed the sutras from stray references scattered throughout the Atharva-veda, making it even more difficult to trace them (Trivedi, 1965).

In response to criticisms that the sutras cannot be located within the texts, several people have explained how textual references should not be the basis for evaluating the Vedicity of the mathematics (Agrawala, 1992). Some propose that Vedic mathematics is different than other scientific work because it is not pragmatically worked out, but is based on a direct revelation, or an "intuitional visualisation" of fundamental mathematical truths (Agrawala, 1992; Pratyagatmananda, 1965). Tirthaji has been described as having the same "reverential approach" towards the Vedas as the ancient rishis that formed them. Thus, it seems as though some believe that Tirthaji may not have found the sutras within the Vedas, but that he received them spiritually as the rishis did, which should validate them as Vedic.

The controversy about the Vedicity of the mathematics is further confused by the double meaning of veda. Since veda can be translated to mean 'knowledge', it is also possible that Vedic mathematics simply refers to the fact that the sutras are supposed to present all knowledge of mathematics. Tirthaji's definition of veda does not clearly clarify whether he uses it to represent 'all knowledge' or the Vedic texts; rather, it seems that he uses it to refer to both:

> The very word 'Veda' has this derivational meaning, i.e. the fountainhead and illimitable store-house of all knowledge. The derivation, in effect, means, connotes and implies that the Vedas should contain within themselves all knowledge needed by mankind relating not only to the 'spiritual' matters but also to those usually described as purely 'secular', 'temporal', or 'worldly' and also to the means required by humanity as such for the achievement of all-round, complete and perfect success in all conceivable directions and that there can be no adjectival or restrictive epithet calculated (or tending) to limit that knowledge down in any sphere, and direction or any respect whatsoever (1992).

Considering the lack of references to the sutras, coupled with the fact that the language style does not seem Vedic, some wager that the sutras were simply composed by Tirthaji himself (Agrawala, 1992). In that case, one must consider what motivated Tirthaji to attribute the mathematical sutras to the ancient texts. Was it because they are from the Vedas, or does claiming so give them more credibility? Other areas of controversy regarding Vedic mathematics focus on the actual mathematics itself. Tirthaji's assertion that the 16 sutras of Vedic mathematics encompass all branches of mathematics is an extreme one even if true, and so it is not surprising that many mathematicians challenge it (Kansara, 1961). They point to the inconsistency between the topics addressed by the system (such as decimal fractions) and the known mathematics of early India, the substantial extrapolations from a few words of a sutra to complex arithmetic strategies, and the restriction of applications to convenient, special cases. They further say that such arithmetic as is sped up by application of the sutras can be performed on a computer or calculator anyway, making their knowledge rather irrelevant in the modern world.

They are also worried that it deflects attention from genuine achievements of ancient and modern Indian mathematics and mathematicians, and that its promotion by Hindu nationalists may damage mathematics education in India.

Additionally, the promotion of Vedic Maths as advanced mathematics has drawn criticism from mathematicians. Although quite useful for practical calculations in daily life, some purport that the "tricks" involved have no application to higher mathematics or mathematical research.

Greatest Common Divisor of Two Polynomials

Informally, the greatest common divisor (GCD) of two polynomials p(x) and q(x) is the "biggest" polynomial that divides evenly into both p(x) and q(x). When dealing with numbers, the definition is similar.

If you have two whole numbers, the greatest common divisor of those numbers is simply the biggest whole number that you can divide into both of them while getting a remainder of zero. The greatest common divisor is also sometimes referred to as the greatest common factor or the highest common factor.

Formal Definition

The greatest common divisor of two polynomials p(x) and q(x), not both zero, with coefficients from a field is the monic polynomial d(x) of highest degree such that d(x) is a common divisor of both p(x) and q(x).

The definition is very specific and this is very important. For example, if both polynomials were zero, then any polynomial would divide them both. In this case, there would be no greatest common divisor. Thus, at least one of the polynomials must be nonzero.

Also, if there were no requirement for the GCD to be monic, there could be several different, even an infinite number of different, GCDs for any two polynomials. This results because any nonzero constant multiple (with constants from the field) of the monic common divisor of highest degree is still a common divisor of highest degree.

Finally, the definition states the coefficients must come from a field. If the coefficients could come from any ring, then factorization would not necessarily be unique. For example, in (Z/6Z),

$(2x + 1)(3x + 1) = 6x^2 + 5x + 1 = 5x + 1$

and

$5(x + 5) = 5x + 25 = 5x + 1.$

All of these details together ensure that there is a GCD and that the GCD is unique.

Properties

- As stated above, the GCD of two nonzero polynomials, with coefficients from a field, is unique.
- If c(x) is any common divisor of p(x) and q(x), then c(x) divides d(x). This is sometimes given in the definition instead of requiring d(x) to be the common divisor of highest degree. The two definitions are logically equivalent.
- The GCD of two polynomials, p(x) and q(x), can be written as a linear combination of p(x) and q(x). That is, there exist some polynomials, in the same field, r(x) and s(x), not necessarily unique, such that

  $d(x) = p(x)\ r(x) + q(x)\ s(x).$

Methods for Finding the GCD

There are several ways to find the greatest common divisor of two polynomials. Some of them include:

1. Factorization, in which one finds the factors of each expression, then selects the set of common factors held by all from within each set of factors.
2. The Euclidean Algorithm, which can be used to find the GCD of two polynomials in the same manner as for two numbers.
3. Swami Bharati Krishna Tirtha's Vedic mathematics contains a method, here called the Vedic method, which is mainly an application of the Lopana-Sthapana Sutra, the Sankalna-Vyavakalan process, and the Adyamadya rule. The sutra is a formula for the alternate destruction of the highest and lowest powers (by the addition or subtraction of multiples of the coefficients).

Factoring

To find the GCD of two polynomials using factoring, simply factor the two polynomials completely.

Then, take the product of all common factors. At this stage, we do not necessarily have a monic polynomial, so finally multiply this by a constant to make it a monic polynomial.

This will be the GCD of the two polynomials as it includes all common divisors and is monic.

EXAMPLE ONE

Find the GCD of $x^2 + 7x + 6$ and $x^2 - 5x - 6$.

$x^2 + 7x + 6 = (x + 1)(x + 6)$

$x^2 - 5x - 6 = (x + 1)(x - 6)$

Thus, their GCD = $(x + 1)$.

Euclidean Algorithm

Finding the GCD by factoring is intuitively simple but requires knowing how to factor the polynomials, which can be difficult, especially if the polynomials have large degree. The Euclidean Algorithm is a fast method which works for any pair of polynomials.

It makes repeated use of division with remainder, just as when the Euclidean Algorithm is applied to two numbers. When using the Euclidean Algorithm on two numbers, the size of the numbers decreases at each stage. With polynomials, the degree of the polynomials decreases at each stage. The last nonzero remainder, made monic if necessary, is the GCD of the two polynomials.

EXAMPLE ONE

Find the GCD of $x^2 + 7x + 6$ and $x^2 - 5x - 6$.

$x^2 + 7x + 6 = (x^2 - 5x - 6)(1) + (x + 1)(12)$

$x^2 - 5x - 6 = (x + 1)(x - 6) + 0$

Since $x + 1$ is the last nonzero remainder, the GCD of these polynomials is $x + 1$.

Algebraic proof of the Vedic method for finding the GCD

Let P and Q be two expressions. Let H be their GCD. Let A and B be the quotients (after dividing by the GCD). Therefore, $P/H = A$ and $Q/H = B$ and also $P = HA$ and $Q = HB$. Therefore $P \pm Q = H(A \pm B)$ and $MP \pm NQ = H(MA \pm NB)$ Therefore, the GCD of P and Q is also the GCD of $P \pm Q$, $2P \pm Q$, $P \pm 2Q$, and $MP \pm NQ$. So, when we select our M and N so that the highest and lowest powers are removed, then the GCD appears and shows itself!

EXAMPLES

Example 1: the Vedic Method

Find the GCD of $x^2 + 7x + 6$ and $x^2 - 5x - 6$. To eliminate the x-squared terms, just subtract the expressions.

To eliminate the constant terms, simply add the two expressions. Then, pull out any common factors to reveal the GCD.

$x^2 + 7x + 6$ $\qquad\qquad$ $x^2 + 7x + 6$

Subtract: $-(x^2 - 5x - 6)$ $\qquad\qquad$ Add: $+ (x^2 - 5x - 6)$

$12x + 12 = 12(x + 1)$ $\qquad\qquad$ $2x^2 + 2x = 2x(x+1)$

Thus, their GCD = $(x+1)$.

Example 2: Vedic Method

$E_1 = x^3 - 3x^2 - 4x + 12$ $\qquad\qquad$ $E_2 = x^3 - 7x^2 + 16x - 12$

Minus $-(x^3 - 7x^2 + 16x - 12)$ $\qquad\qquad$ Add $+(x^3 - 3x^2 - 4x + 12)$

$4x^2 - 20x + 24$ $\qquad\qquad$ $2x^3 - 10x^2 + 12x$

Remove common factors: $4(x^2 - 5x + 6)$ $\quad$ $2x(x^2-5x+6)$

Their GCD = (x^2-5x+6)

Example 3: Factorization

Find the GCD of the two expressions after factorization:

$E_1 = x^4 + x^3 - 5x^2 - 3x + 2 = (x+1)(x-2)(x2+2x-1)$

and $E_2 = x^4 - 3x^3 + x^2 + 3x - 2 = (x+1)(x-2)(x-1)^2$

Seeing the shared factors are the binomials $(x+1)(x-2)$ we have them as the GCD.

Example 4: Vedic Method

Find the GCD of two expressions by elimination and retention of the highest and the lowest powers.

$E_1 = x^4 + x^3 - 5x^2 - 3x + 2$ $\qquad\qquad$ $E_1 = x^4 + x^3 - 5x^2 - 3x + 2$

and $E2 = x^4 - 3x^3 + x^2 + 3x - 2$ $\qquad\qquad$ $E_2 = x^4 - 3x^3 + x^2 + 3x - 2$

The sum: $2x^4 - 2x^3 - 4x^2$ $\quad$ Their difference: $4x^3 - 6x^2 - 6x + 4$

Pull out the common factors:

$(2x^2)(x2 - x - 2)$ $\qquad\qquad$ $(2)(2x^3 - 3x^2 - 3x + 2)$

Restore a factor of (2x) for a second elimination.

Multiply by $(2x)(x^2 -x -2) = 2x^3 -2x^2 -4x$

Subtract second result from first result:

$2x^3 -3x^2 -3x + 2$

Minus $-(2x^3 -2x^2 -4x)$

$- x^2 +x + 2$

Since the expressions have positive x2 terms remove the factor of -1:

Their GCD = $(x^2 -x -2)$

Example 5: Vedic Method

Find the GCD of two expressions.

$E_1 = 6x^4 - 7x^3 - 5x^2 + 14x +7$

$E_2 = 3x^3 - 5x^2 +7$

To eliminate the 4th power: $E_1 + (-2x)(E_2)$.

Subtract: E1 - E2 to eliminate the constant terms.

$6x^4 - 7x^3 -5x^2 +14x +7$

$6x^4 - 7x^3 -5x^2 +14x +7$

$(-2x)(3x^3$-5x2+7)= add +(6x4 $+10x^3 -14x)$

Minus $-(3x^3 -5x^2 +7)$

$3x^3 -5x^2 +7$

$6x^4 -10x^3 +14x$

Take out the common factor: $(2x)(3x^3 -5x^2 +7)$

The GCD = $(3x^3 -5x^2 +7)$

Partial Fraction

In algebra, the partial fraction decomposition or (partial fraction expansion) is used to reduce the degree of either the numerator or the denominator of a rational function. The outcome of partial fraction expansion expresses that function as a sum of fractions, where:

- the denominator of each term is a power of an irreducible (not factorable) polynomial and
- the numerator is a polynomial of smaller degree than the denominator.

See partial fractions in integration for an account of their use in finding antiderivatives. They are also used in calculating the inverse of transforms; such as the Laplace transform, or the Z-transform.

Just which polynomials are irreducible depends on which field of scalars one adopts. Thus if one allows only real numbers, then irreducible polynomials are of degree either 1 or 2. If complex numbers are allowed, only 1st-degree polynomials can be irreducible. If one allows only rational numbers, then some higher-degree polynomials are irreducible.

One can use partial fraction expansion for one of two main uses:

- To change a function in the form $\frac{f(x)}{x+a}$ into a function of the form $\frac{A}{x+a}+\sum\frac{g_n(x)}{1}$
- To change a function in the form $\frac{f(x)}{g(x)}$ into a function of the form $\sum\frac{A_n}{g(x)/h_n(x)}$.

SOME EXAMPLES

If one wants to decompose x/(x+a), then one can follow these steps:

$$\frac{x}{x+a}=A+\frac{B}{x+a}$$

where A, B, and a are constants

$x + 0 = A(x + a) + B$

$x = Ax$ and $0 = Aa + B$

and

therefore

$A = 1$ and $B = -a$

Distinct First-degree Factors in the Denominator

Suppose it is desired to decompose the rational function

$$\frac{x+3}{x^2-3x-40}$$

into partial fractions. The denominator factors as

$(x - 8)(x + 5)$

and so we seek scalars A and B such that

$$\frac{x+3}{x^2-3x-40}=\frac{x+3}{(x-8)(x+5)}=\frac{A}{x-8}+\frac{B}{x+5}.$$

One way of finding A and B begins by "clearing fractions", i.e., multiplying both sides by the common denominator $(x - 8)(x + 5)$. This yields

$x + 3 = A(x + 5) + B(x - 8).$

Collecting like terms gives

$x + 3 = (A + B)x + (5A - 8B).$

Equating coefficients of like terms then yields:

$$A + B = 1$$

$$5A - 8B = 3$$

The solution is $A = 11/13$, $B = 2/13$. Thus we have the partial fraction decomposition

$$\frac{x+3}{x^2-3x-40}=\frac{\frac{11}{13}}{x-8}+\frac{\frac{2}{13}}{x+5}.$$

An Irreducible Quadratic Factor in the Denominator

In order to decompose

$$\frac{10x^2+12x+20}{x^3-8}$$

into partial fractions, first observe that

$x^3 - 8 = (x - 2)(x^2 + 2x + 4)$.

The fact that x2 + 2x + 4 cannot be factored using real numbers can be seen by observing that the discriminant 22 - 4(1)(4) is negative. Thus we seek scalars A, B, C such that

$$\frac{10x^2+12x+20}{x^3-8}=\frac{10x^2+12x+20}{(x-2)(x^2+2x+4)}=\frac{A}{x-2}+\frac{Bx+C}{x^2+2x+4}.$$

When we clear fractions, we get

$10x^2 + 12x + 20 = A(x^2 + 2x + 4) + (Bx + C)(x - 2)$

We could proceed as in the previous example, getting three linear equations in three variables A, B, and C. However, since solving such systems becomes onerous as the number of variables grows, we try a different method. Substitution of 2 for x in the identity above makes the entire second term vanish, and we get

$10.2^2 + 12.2 + 20 = A(2^2 + 2.2 + 4)$,

i.e., 84 = 12A, so A = 7, and we have

$10x^2 + 12x + 20 = 7(x^2 + 2x + 4) + (Bx + C)(x - 2)$.

Next, substitution of 0 for x yields

$20 = 7(4) + C(-2)$,

and so C = 4. We now have

$10x^2 + 12x + 20 = 7(x^2 + 2x + 4) + (Bx + 4)(x - 2)$.

Substitution of 1 for x yields

$10 + 12 + 20 = 7(1 + 2 + 4) + (B + 4)(1 - 2)$,

and so B = 3.

Our partial fraction decomposition is therefore:

$$\frac{10x^2+12x+20}{x^3-8}=\frac{7}{x-2}+\frac{3x+4}{x^2+2x+4}.$$

A Repeated First-degree Factor in the Denominator

Consider the rational function

$$\frac{10x^2-63x+29}{x^3-11x^2+40x-48}.$$

The denominator factors thus:

$x^3 - 11x^2 + 40x - 48 = (x - 3)(x - 4)^2$.

The multiplicity of the first-degree factor (x - 4) is more than 1. In such cases, the partial fraction decomposition takes the following form:

$$\frac{10x^2-63x+29}{x^3-11x^2+40x-48}=\frac{10x^2-63x+29}{(x-3)(x-4)^2}=\frac{A}{x-3}+\frac{B}{x-4}+\frac{C}{(x-4)^2}.$$

Repeated Factors in the Denominator Generally

For rational functions of the form

$$\frac{p(x)}{(x+2)(x+3)^5}$$

(where the p(x) may be any polynomial of sufficiently small degree) the partial fraction decomposition looks like this:

$$\frac{A}{x+2}+\frac{B}{x+3}+\frac{C}{(x+3)^2}+\frac{D}{(x+3)^3}+\frac{E}{(x+3)^4}+\frac{F}{(x+3)^5}.$$

The general pattern may be quickly guessed.

For rational functions of the form

$$\frac{p(x)}{(x+2)(x^2+1)^5}$$

with the irreducible quadratic factor $x^2 + 1$ in the denominator (where again, the p(x) may be any polynomial of sufficiently small degree), the partial fraction decomposition looks like this:

$$\frac{A}{x+2}+\frac{Bx+C}{x^2+1}+\frac{Dx+E}{(x^2+1)^2}+\frac{Fx+G}{(x^2+1)^3}+\frac{Hx+I}{(x^2+1)^4}+\frac{Jx+K}{(x^2+1)^5},$$

and a similar pattern holds for any other irreducible quadratic factor.

High-degree Polynomials in the Numerator

When you need to apply the partial fraction decomposition to a polynomial division like

$$\frac{a_n x^n + \dots + a_1 x + a_0}{b_m x^m + \dots + b_1 x + b_0}$$

where $n \geq m$, you just need to make the polynomial long division procedure first, and apply the partial fraction decomposition to the remainder.

Use in Deriving the Logistic General Equation

In many beginning calculus courses, partial fractions are introduced as a way to derive the general equation for a logistic function.

Logistic functions model a population which grows until it reaches a limit. The rate of change for the function is proportional (constant k) to both the population reached (P) and the fraction of the total carrying capacity (M) remaining. Thus:

$$\frac{dP}{dt}=kP\left(\frac{M-P}{M}\right)$$

$$\int\frac{1}{P(M-P)}dP=\int\frac{k}{M}dt$$

$$\frac{1}{P(M-P)}=\frac{A}{P}+\frac{B}{(M-P)}$$

$$1 = A(M - P) + BP$$

$$1 = AM - AP + BP$$

$$A = B,\ A = \frac{1}{M},\ B = \frac{1}{M}$$

$$\int \frac{1}{MP} + \frac{1}{M(M-P)} dP = \int \frac{k}{M} dt$$

$$\int \frac{1}{P} + \frac{1}{(M-P)} dP = \int k\, dt$$

$$\ln \frac{P}{(P-M)} = kt + C$$

$$\frac{P}{P-M} = e^{kt+C}$$

$$\frac{M-P}{P} = e^{-kt-C}$$

$$\frac{M}{P} - 1 = e^{-kt-C}$$

$$P = \frac{M}{e^{-kt-C} + 1}$$

$$P = \frac{M}{Ae^{-kt} + 1}$$

6

Vedic Mathematical Sutras

Consider the following three sutras:

1. "All from 9 and the last from 10," and its corollary: "Whatever the extent of its deficiency, lessen it still further to that very extent; and also set up the square (of that deficiency)."
2. "By one more than the previous one," and its corollary: "Proportionately."
3. "Vertically and crosswise," and its corollary: "The first by the first and the last by the last."

The first rather cryptic formula is best understood by way of a simple example: let us multiply 6 by 8.

1. First, assign as the base for our calculations the power of 10 nearest to the numbers which are to be multiplied. For this example our base is 10.
2. Write the two numbers to be multiplied on a paper one above the other, and to the right of each write the remainder when each number is subtracted from the base 10. The remainders are then connected to the original numbers with minus signs, signifying that they are less than the base 10.

6-4

8-2

3. The answer to the multiplication is given in two parts. The first digit on the left is in multiples of 10 (i.e. the 4 of the answer 48). Although the answer can be arrived at by four different ways, only one is presented here. Subtract the sum of the two deficiencies (4 + 2 = 6) from the base (10) and obtain 10 - 6 = 4 for the left digit (which in multiples of the base 10 is 40).

6-4
8-2

4

4. Now multiply the two remainder numbers 4 and 2 to obtain the product 8. This is the right hand portion of the answer which when added to the left hand portion 4 (multiples of 10) produces 48.

6-4
8-2

4/8

Another method employs cross subtraction. In the current example the 2 is subtracted from 6 (or 4 from 8) to obtain the first digit of the answer and the digits 2 and 4 are multiplied together to give the second digit of the answer. This process has been noted by historians as responsible for the general acceptance of the X mark as the sign of multiplication. The algebraical explanation for the first process is

$$(x - a)(x - b) = x(x - a - b) + ab$$

where x is the base 10, a is the remainder 4 and b is the remainder 2 so that

$$6 = (x-a) = (10-4)$$

$$8 = (x-b) = (10-2)$$

The equivalent process of multiplying 6 by 8 is then

$$x(x-a-b) + ab \text{ or}$$

$$10(10-4-2) + 2\times4 = 40 + 8 = 48$$

These simple examples can be extended without limitation. Consider the following cases where 100 has been chosen as the base:

$$\begin{array}{lll} 97 - 3 & 93 - 7 & 25 - 75 \\ 78 - 22 & 92 - 8 & 98 - 2 \\ \hline 75 / 66 & 85 / 56 & 23 / 150 \quad = 24/50 \end{array}$$

In the last example we carry the 100 of the 150 to the left and 23 (signifying 23 hundred) becomes 24 (hundred). Herein the sutra's words "all from 9 and the last from 10" are shown. The rule is that all the digits of the given original numbers are subtracted from 9, except for the last (the righthand-most one) which should be deducted from 10.

Consider the case when the multiplicand and the multiplier are just above a power of 10. In this case we must cross-add instead of cross subtract. The algebraic formula for the process is: $(x+a)(x+b) = x(x+a+b) + ab$. Further, if one number is above and the other below a power of 10, we have a combination of subtraction and addition: viz:

$$\begin{array}{rr} 108 + 8 \text{ and} & 13 + 3 \\ 97 - 3 & 8 - 2 \\ \hline 105/-24 & 11/-6 \\ = 104/(100-24) & = 10/(10-6) \\ = 104/76 & = 10/4 \end{array}$$

The Sub-Sutra: "Proportionately" Provides for those cases where we wish to use as our base multiples of the normal base of powers of ten. That is, whenever neither the multiplicand nor the multiplier is sufficiently near a convenient power of 10, which could serve as our base we simply use a multiple of a power of ten as our working base, perform our calculations with this working base and then multiply or divide the result proportionately.

To multiply 48 by 32, for example, we use as our base 50 = 100/2, so we have

Base 50 48 - 2

32 - 18

2/ 30/36 or (30/2) / 36 = 15/36

Note that only the left decimals corresponding to the powers of ten digits (here 100) are to be effected by the proportional division of 2. These examples show how much easier it is to subtract a few numbers, (especially for more complex calculations) rather than memorize long mathematical tables and perform cumbersome calculations the long way.

Squaring Numbers

The algebraic equivalent of the sutra for squaring a number is: $(a+-b)^2 = a^2 +- 2ab + b^2$. To square 103 we could write it as $(100 + 3)^2 = 10{,}000 + 600 + 9 = 10{,}609$. This calculation can easily be done mentally. Similarly, to divide 38,982 by 73 we can write the numerator as $38x^3 + 9x^2 + 8x + 2$, where x is equal o 10, and the denominator is $7x + 3$. It doesn't take much to figure out that the numerator can also be written as $35x^3 + 36x^2 + 37x + 12$. Therefore,

$$38{,}982/73$$

$$= (35x^3 + 36x^2 + 37x + 12)/(7x + 3)$$

$$= 5x^2 + 3x + 4 = 534$$

This is just the algebraic equivalent of the actual method used. The algebraic principle involved in the third sutra, "vertically and crosswise," can be expressed, in one of it's applications, as the multiplication of the two numbers represented by (ax + b) and (cx + d), with the answer $acx^2 + x(ad + bc) + bd$. Differential calculus also is utilized in the Vedic sutras for breaking down a quadratic equation on sight into two simple equations of the first degree. Many additional sutras are given which provide simple mental one or two line methods for division, squaring of numbers, determining square and cube roots, compound additions and subtractions, integrations, differentiations, and integration by partial fractions, factorisation of quadratic equations, solution of simultaneous equations, and many more. For demonstrational purposes, we have only presented simple examples.

Historical Background

The ancient system of Vedic Mathematics was rediscovered from the Vedas between 1911 and 1918 by Sri Bharati Krsna Tirthaji (1884-1960). The word 'Veda' means 'knowledge' and also refers to a set of ancient Indian texts written in Sanskrit. The date these texts were written is unknown but the content of the Vedas was passed on by an oral tradition long before writing was invented. The Vedas are said to cover every aspect and area of knowledge: grammar, architecture, ethics, astronomy etc. are all covered. At the beginning of the twentieth century, when there was a great interest in the Sanskrit texts in Europe, Bharati Krsna tells us some scholars ridiculed certain texts which were headed 'Ganita Sutras'- which means mathematics. They could find no mathematics in the translation and dismissed the texts as rubbish. Bharati Krsna, who was himself a scholar of Sanskrit, Mathematics, History and Philosophy, studied these texts and after lengthy and careful investigation was able to reconstruct the mathematics of the Vedas. According to his research all of mathematics is based on sixteen Sutras, or word-formulae. For example, Vertically and Crosswise is one of these Sutras. The credibility of this extraordinary claim that all of mathematics, pure and applied, is governed by sixteen formulae is discussed in the page on The Sutras of Vedic Mathematics.

Bharati Krsna wrote sixteen volumes expounding the Vedic system but these were unaccountably lost and when the loss was confirmed in his final years he wrote a single book: Vedic Mathematics, currently available. It was published in 1965, five years after his death. A copy of the book was brought to London a few years later and some English mathematicians (Kenneth Williams, Andrew Nicholas, Jeremy Pickles) took an interest in it. They extended the introductory material given in Bharati Krsna's book and gave many courses and talks in London. A book (now out of print), Introductory Lectures on Vedic Mathematics, was published in 1981. Between 1981 and 1987 Andrew Nicholas made four trips to India initially to find out what further was known about it.

Following these journeys a renewed interest was taken by scholars and teachers in India. It seems that once they saw that some people in the West took Vedic Mathematics seriously they realised they had something special. St. James' School, then in Queensgate, London and other schools began to teach the Vedic system, with notable success. Today Vedic Mathematics is taught widely in schools in India and a great deal of research is being done. Three further books appeared in 1984 (those numbered 3, 6 and 7 in this site), the year of the centenary of the birth of Sri Bharati Krsna Tirthaji. These were published by The Vedic Mathematics Research Group.

When Maharishi Mahesh Yogi began to explain the significance and marvellous qualities of Vedic Mathematics in 1988 Maharishi schools around the world began to teach it. At the school in Skelmersdale, Lancashire a full course was written and trialled for 11 to 14 year old pupils, called The Cosmic Computer. (Maharishi had said that the Sutras of Vedic Mathematics are the software for the cosmic computer- the cosmic computer runs the entire universe on every level and in every detail). This course was published in March 1998.

Here we use When the Samuccaya is the same it is zero. This gives $3x-12=0$, so $x=4$.

The same formula also gives the other solution to the equation, so $x-7=0$ and $x=7$.

Nuggets from Vedic Mathematics

The Vedas are ancient holy texts from India than can be legitimately characterized as the all-encompassing repository of (Hindu) knowledge from eons past. The term Vedic Mathematics refers to a set of sixteen mathematical formulae or sutras and their corollaries derived from the Vedas. The sixteen sutras are:

1. Ekadhikena Purvena
2. Nikhilam Navatashcaramam Dashatah
3. Urdhva-tiryagbhyam
4. Paraavartya Yojayet
5. Shunyam Saamyasamuccaye
6. (Anurupye) Shunyamanyat
7. Sankalana-vyavakalanabhyam
8. Puranapuranabhyam
9. Chalana-Kalanabhyam
10. Yaavadunam
11. Vyashtisamanshtih
12. Shesanyankena Charamena
13. Sopaantyadvayamantyam
14. Ekanynena Purvena
15. Gunitasamuchyah
16. Gunakasamuchyah

Vedic Number Representation

Vedic knowledge is in the form of slokas or poems in Sanskrit verse. A number was encoded using consonant groups of the Sanskrit alphabet, and vowels were provided as additional latitude to the author in poetic composition. The coding key is given as Kaadi nav, taadi nav, paadi panchak, yaadashtak ta ksha shunyam Translated as below

- letter "ka" and the following eight letters
- letter "ta" and the following eight letters .
- letter "pa" and the following four letters
- letter "ya" and the following seven letters, and
- letter "ksha" for zero.

In other words,

- ka, ta, pa, ya = 1
- kha, tha, pha, ra = 2
- ga, da, ba, la = 3
- gha, dha, bha, va = 4
- gna, na, ma, scha = 5
- cha, ta, sha = 6
- chha, tha, sa = 7
- ja, da, ha = 8
- jha, dha = 9
- ksha = 0

For those of you who don't know or remember the varnmala, here it is:

ka kha ga gha gna
cha chha ja jha inya
Ta Tha Rda Dha Rna
ta tha da dha na
pa pha ba bha ma

ya ra la va scha
sha sa ha chjha tra gna

Thus pa pa is 11, ma ra is 52. Words kapa, tapa , papa, and yapa all mean the same that is 11. It was upto the author to choose one that fit the meaning of the verse well. An interesting example of this is a hymn below in the praise of God Krishna that gives the value of Pi to the 32 decimal places as .31415926535897932384626433832792.

Gopi bhaagya madhu vraata

Shrngisho dadhisandhiga

Khalajivita khaataava

Galahaataarasandhara

1. *Ekadhikena Purvena*

or By one more than the previous one.

The proposition "by" means the operations this sutra concerns are either multiplication or division. [In case of addition/subtraction proposition "to" or "from" is used.] Thus this sutra is used for either multiplication or division. It turns out that it is applicable in both operations.

An interesting application of this sutra is in computing squares of numbers ending in five. Consider:

35x35 = (3x(3+1)) 25 = 12,25

The latter portion is multiplied by itself (5 by 5) and the previous portion is multiplied by one more than itself (3 by 4) resulting in the answer 1225.

It can also be applied in multiplications when the last digit is not 5 but the sum of the last digits is the base (10) and the previous parts are the same. Consider:

37 × 33 = (3×4), 7×3 = 12,21

29 × 21 = (2×3), 9×1 = 6,09 [Antyayor dashake]

We illustrate this sutra by its application to conversion of fractions into their equivalent decimal form. Consider fraction 1/19. Using this sutra this can be converted into a decimal form in a single step.

This can be done either by applying the sutra for a multiplication operation or for a division operations, thus yielding two methods.

METHOD 1: USING MULTIPLICATIONS

1/19, since 19 is not divisible by 2 or 5, the fractional result is a purely circulating decimal. (If the denominator contains only factors 2 and 5 is a purely non-circulating decimal, else it is a mixture of the two.)

So we start with the last digit

1

Multiply this by "one more", that is, 2 (this is the "key" digit from Ekadhikena)

21

Multiplying 2 by 2, followed by multiplying 4 by 2

421 ⇒ 8421

Now, multiplying 8 by 2, sixteen

68421

1 ⇐ carry

multiplying 6 by 2 is 12 plus 1 carry gives 13

368421

1 ⇐ carry

Continuing

7368421 ⇒ 47368421 ⇒ 947368421

1

Now we have 9 digits of the answer. There are a total of 18 digits (=denominator-numerator) in the answer computed by complementing the lower half:

052631578

947368421

Thus the result is .052631578,947368421

METHOD 2: USING DIVISIONS

The earlier process can also be done using division instead of multiplication. We divide 1 by 2, answer is 0 with remainder 1

.0

Next 10 divided by 2 is five

.05

Next 5 divided by 2 is 2 with remainder 1

.052

next 12 (remainder,2) divided by 2 is 6

.0526

and so on.

As another example, consider 1/7, this same as 7/49 which as last digit of the denominator as 9. The previous digit is 4, by one more is 5. So we multiply (or divide) by 5, that is,

...7 ⇒ 57 ⇒ 857 ⇒ 2857 ⇒ 42857 ⇒ 142857 ⇒ .142,857 (stop after 7-1 digits)

3 2 4 1 2

2. Nikhilam Navatashcaramam Dashatah

or All from nine and the last from ten.

This sutra is often used in special cases of multiplication.

Corollary 1: Yavdunam Jaavdunikritya Varga Cha Yojayet

or Whatever the extent of its deficiency, lessen it still further to that very extent; and also set up the square of that deficiency.

For instance: in computing the square of 9 we go through the following steps:

The nearest power of 10 to 9 is 10. Therefore, let us take 10 as our base.

Since 9 is 1 less than 10, decrease it still further to 8. This is the

left side of our answer.

On the right hand side put the square of the deficiency, that is 1^2.

Hence the answer is 81.

Similarly, 8^2 = 64, 7^2 = 49

For numbers above 10, instead of looking at the deficit we look at the surplus. For example:

11^2 = 12 1^2 = 121

12^2 = (12+2) 2^2 = 144

14^2 = (14+4) 4^2 = 18 16 = 196

and so on.

3. *Urdhva-tiryagbhyam*

or Vertically and crosswise.

This sutra applies to all cases of multiplication and is very useful in division of one large number by another large number.

4. *Paraavartya Yojayet*

or Transpose and apply.

This sutra complements the Nikhilam sutra which is useful in divisions by large numbers. This sutra is useful in cases where the divisor consists of small digits. This sutra can be used to derive the Horner's process of Synthetic Division.

5. Shunyam Saamyasamuccaye

or When the samuccaya is the same, that samuccaya is zero.

This sutra is useful in solution of several special types of equations that can be solved visually. The word samuccaya has various meanings in different applicatins. For instance, it may mean a term which occurs as a common factor in all the terms concerned. A simple example is equation "12x + 3x = 4x + 5x". Since "x" occurs as a common factor in all the terms, therefore, x=0 is a solution. Another meaning may be that samuccaya is a product of independent terms. For instance, in (x+7)(x+9) = (x+3)(x+21), the samuccaya is 7 x 9 = 3 x 21, therefore, x = 0 is a solution. Another meaning is the sum of the denominators of two fractions having the same numerical numerator, for example: 1/(2x-1) + 1/(3x-1) = 0 means 5x - 2 = 0.

Yet another meaning is "combination" or total. This is commonly used. For instance, if the sum of the numerators and the sum of denominators are the same then that sum is zero. Therefore,

$$\frac{2x+9}{2x+7}=\frac{2x+7}{2x+9}$$

therefore, 4x + 16 = 0 or x = -4

This meaning ("total") can also be applied in solving quadratic equations. The total meaning can not only imply sum but also subtraction. For instance when given N1/D1 = N2/D2, if N1+N2 = D1 + D2 (as shown earlier) then this sum is zero. Mental cross multiplication reveals that the resulting equation is quadratic (the coefficients of x^2 are different on the two sides). So, if N1 - D1 = N2 - D2 then that samuccaya is also zero. This yield the other root of a quadratic equation.

Yet interpretation of "total" is applied in multi-term RHS and LHS. For instance, consider

$$\frac{1}{x-7}+\frac{1}{x-9}=\frac{1}{x-6}+\frac{1}{x-10}$$

Here D1 + D2 = D3 + D4 = 2 x - 16. Thus x = 8.

There are several other cases where samuccaya can be applied with great versatility. For instance "apparently cubic" or "biquadratic" equations can be easily solved as shown below:

(x-3)^3 + (x-9)^3 = 2 (x-6)^3

Note that x -3 + x - 9 = 2 (x - 6). Therefore (x - 6) = 0 or x = 6.

consider

$$\frac{(x+3)^{\wedge}3}{(x+5)^{\wedge}3}=\frac{x+1}{x+7}$$

Observe: N1 + D1 = N2 + D2 = 2x + 8.

Therefore, x = -4.

This sutra has been extended further.

6. *(Anurupye) Shunyamanyat*

or If one is in ratio, the other one is zero.

This sutra is often used to solve simultaneous simple equations which may involve big numbers. But these equations in special cases can be visually solved because of a certain ratio between the coefficients. Consider the following example:

$6x + 7y = 8$

$19x + 14y = 16$

Here the ratio of coefficients of y is same as that of the constant terms.

Therefore, the "other" is zero, i.e., $x = 0$. Hence the solution of the

equations is $x = 0$ and $y = 8/7$.

This sutra is easily applicable to more general cases with any number of variables. For instance

$ax + by + cz = a$

$bx + cy + az = b$

$cx + ay + bz = c$

which yields $x = 1$, $y = 0$, $z = 0$.

A corollary (upsutra) of this sutra says Sankalana-Vyavakalanaabhyam or By addition and by subtraction. It is applicable in case of simultaneous linear equations where the x- and y-coefficients are interchanged. For instance:

$45x - 23y = 113$

$23x - 45y = 91$

By addition:

$68x - 68y = 204 \Rightarrow 68(x-y) = 204 \Rightarrow x - y = 3$

By subtraction:

$22x + 22y = 22 \Rightarrow 22(x+y) = 22 \Rightarrow x + y = 1$

7. *Puranapuranabhyam*

or By the completion or non-completion.

8. *Ekanynena Purvena*

It is converse of the Ekaadhika sutra. It provides for multiplications wherein the multiplier digits consist entirely of nines.

"Rules of Thumb"

Many of the basic sutras have been applied to devise commonly used rules of thumb. For instance, the Ekanyuna sutra can be used to derive the following results:

- Kevalaih Saptakam Gunyaat, or in the case of seven the multiplicand should be 143
- Kalau Kshudasasaih, or in the case of 13 the multiplicand should be 077
- Kamse Kshaamadaaha-khalairmalaih, or in the case of 17 the multiplicand should be 05882353 (by the way, the literal meaning of this result is "In king Kamsa's reign famine, and unhygenic conditions prevailed." -- not immediately obvious what it had to do with Mathematics. These multiple meanings of these sutras were one of the reasons why some of the early translations of Vedas missed discourses on vedaangas.)

These are used to correctly identify first half of a recurring decimal number, and then applying Ekanyuna to arrive at the complete answer mechanically. Consider for example the following visual computations:

1/7 = 143x999/999999 = 142857/999999 = 0.142857

1/13 = 077x999/999999 = 076923/999999 = 0.076923

1/17 = 05882353x99999999/9999999999999999

= 0.05882352 94117647

Note that

7×142857 = 999999

13×076923 = 999999

17×05882352 94117647 = 9999999999999999

which says that if the last digit of the denominator is 7 or 3 then the last digit of the equivalent decimal fraction is 7 or 3 respectively.

Some Interesting Nuggets and Examples:

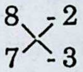
- The Multiplication Sign "X" as a Cross-Addition: Let us multiply (decimal numbers) 8 by 7: first column lists the numbers and the second column the deficits (from base = 10):

$$\begin{array}{rr} 8 & -2 \\ \times 7 & -3 \\ \hline \end{array}$$

The multiplication proceeds from the most signficant digit to least significant digit (which is natural since the positional numbers are also read from MSD to LSD, thus the result can be produced "on-line"). The first digit (most significant digit) is obtained by

1. adding 8 and -3, or
2. adding 7 and -2, or

that is,



This process of obtaining MSD of a multiplication by cross-addition is said to be the origin of the conventional cross sign for multiplication. BTW, you can generate the following digit by multiplication and (if necessary) by forwarding the carry to more significant digits. This method (derived from Nikhilam sutra) works multiplication of multidigit numbers and numbers greater than as well as less than the base (or half the base). Consider bit more complex examples below:

$$\begin{array}{rr} 97 & -3 \\ \times 98 & -2 \\ \hline 95, & 06 \end{array} \quad \begin{array}{rr} 102 & 2 \\ \times 104 & 4 \\ \hline 106, & 08 \end{array} \quad \begin{array}{rr} 888 & -112 \\ \times 997 & -003 \\ \hline 885, & 336 \end{array}$$

For cases when the numbers are closer to the middle of the base, Anurupyena sutra (according to the ratio) can be used to compute deficit/excess from a ratio of the base and then ratio the result:

$$\begin{array}{ll} 48 & -2 \quad (\text{base}/2 = 50) \\ \times 46 & -4 \\ \hline 44, & 08 \Rightarrow 22, 08 \end{array}$$

- Division using "Seshaanyankaani charamena": to carry out a division first compute remainders and then multiply the remainders by the last digit and put down the last digit of the multiplicand. Consider: 1/7. When divising 1(0) by 7 the remainder is 3. Therefore, dividing 3 by 7 will subsequently lead to remainder 9 (= 3x3). But since 9 is more than 7 the remainder would be 2, so the remainder sequence is:
- 3, 2

Now 2 divided by 7 will have remainder of 6 (3×2), that is

3, 2, 6

Continuing

3, 2, 6, 4, 5, 1

We stop when the remainder sequence starts to repeat. Now, multiply these remainders by the last digit (7) of the denominator and keep only the first digit (LSD). So we have:

7 × 3 = 21 ⇒ put down 1

.1

3, 2, 6, 4, 5, 1

7 × 2 = 14 ⇒ put down 4

.1 4

3, 2, 6, 4, 5, 1

7 × 6 = 42 ⇒ put down 2

.1 4 2

3, 2, 6, 4, 5, 1

Continuing

.1 4 2 8 5 7

3, 2, 6, 4, 5, 1

So the answer is 1/7 = .142857142857...

Why the Vedic Math Important?

History : An ancient system of mathematics, Vedic Math is based on simple rules and principles through which any mathematical problem - be it Arithmetic, Algebra, Geometry or Trigonometry can be solved orally ! Vedic math is a set of sixteen Sanskrit mathematical formulae or sutras and their corollaries derived from the Vedas, which were formulated over centuries. The Sutras were lost over time but thankfully, re- discovered by Jagadguru Swami Sri Bharati Krsna Tirthaji Maharaja between 1911 and 1918.

MATH SUTRAS

Natural Formulae: The system is based on 16 Vedic sutras or aphorisms which are actually word - formulae that describe natural ways of solving a range of mathematical problems.

Some examples of sutras are "By one more than the one before ", " All from 9 and the last from 10", and "Vertically and Crosswise". These 16 one-line formulae originally written in Sanskrit are easy to remember . These formulae enable you to solve long mathematical problems quickly.

A Simple System : According to common opinion, this method is far more systematic, coherent and unified than the conventional system normally followed in schools. Vedic math is mental tool for calculation that encourages the development and use of intuition and innovation, while giving the student a lot of flexibility fun & satisfaction.

This system of mathematics has is so simple, direct and easy to implement that it is even used by scientists at

NASA - a striking testimony of its enormous popularity among educationists and academicians the world over.

The Sixteen Sutras

Sutras

1 Ekadhikina Purvena
COROLLARY: Anurupyena
Meaning: By one more than the previous one

2 Nikhilam Navatashcaramam Dashatah
COROLLARY: Sisyate Sesasamjnah
Meaning: All from 9 and the last from 10

3 Urdhva-Tiryagbyham
COROLLARY: Adyamadyenantyamantyena
Meaning: Vertically and crosswise

4 Paraavartya Yojayet
COROLLARY: Kevalaih Saptakam Gunyat
Meaning: Transpose and adjust

5 Shunyam Saamyasamuccaye
COROLLARY: Vestanam
Meaning: When the sum is the same that sum is zero.

6 (Anurupye) Shunyamanyat
COROLLARY: Vestanam
Meaning: If one is in ratio, the other is zero

7 Sankalana-vyavakalanabhyam
COROLLARY: Yavadunam Tavadunikritya Vargancha Yojayet
Meaning: By addition and by subtraction

8 Puranapuranabyham
COROLLARY: Antyayordashake'pi
Meaning: By the completion or non-completion

9 Chalana-Kalanabyham
COROLLARY: Antyayoreva
Meaning: Differences and Similarities

10 Yaavadunam
COROLLARY: Samuccayagunitah
Meaning: Whatever the extent of its deficiency

11 Vyashtisamanstih
COROLLARY: Lopanasthapanabhyam
Meaning: Part and Whole

12 Shesanyankena Charamena
COROLLARY: Vilokanam
Meaning: The remainders by the last digit

13 Sopaantyadvayamantyam
COROLLARY: Gunitasamuccayah Samuccayagunitah
Meaning: The ultimate and twice the penultimate

14 Ekanyunena Purvena
COROLLARY: Dhvajanka
Meaning: By one less than the previous one

15 Gunitasamuchyah
COROLLARY: Dwandwa Yoga
Meaning: The product of the sum is equal to the sum of the product

16 Gunakasamuchyah
COROLLARY: Adyam Antyam Madhyam
Meaning: The factors of the sum is equal to the sum of the factors

Ekadhikena Purvena

The Sutra (formula) Ekadhikena Purvena means: "By one more than the previous one".

Now let us apply this sutra to the 'squaring of numbers ending in 5'.

Consider the example 25^2.

Here the number is 25. We have to find out the square of the number. For the number 25, the last digit is 5 and the 'previous' digit is 2. Hence, 'one more than the previous one', that is, 2+1=3. The Sutra, in this context, gives the procedure 'to multiply the previous digit 2 by one more than itself, that is, by 3. It becomes the L.H.S (left hand side) of the result, that is,

2 × 3 = 6. The R.H.S (right hand side) of the result is 5^2, that is, 25.

Thus 25^2 = 2 × 3 / 25 = 6/25=625.

In the same way,

35^2= 3 × (3+1) /25 = 3 × 4/ 25 = 1225;

65^2= 6 × 7 / 25 = 4225;

105^2= 10 × 11/25 = 11025;

135^2= 13 × 14/25 = 18225;

Now try to find out the squares of the numbers 15, 45, 85, 125, 175 and verify the answers.

Vulgar Fractions Whose Denominators are Numbers Ending in NINE

We now take examples of 1 / a9, where a = 1, 2, -----, 9. In the conversion of such vulgar fractions into recurring decimals, Ekadhikena Purvena process can be effectively used both in division and multiplication.

Multiplication Method: Value of 1 / 19

First we recognize the last digit of the denominator of the type 1 / a9. Here the last digit is 9. For a fraction of the form in whose denominator 9 is the last digit, we take the case of 1 / 19 as follows: For 1 / 19, 'previous' of 19 is 1. And one more than of it is 1 + 1 = 2. Therefore 2 is the multiplier for the conversion.

We write the last digit in the numerator as 1 and follow the steps leftwards.

Step. 1 : 1

Step. 2 : 21(multiply 1 by 2, put to left)

Step. 3 : 421(multiply 2 by 2, put to left)

Step. 4 : 8421(multiply 4 by 2, put to left)

Step. 5 : 168421 (multiply 8 by 2=16, 1 carried over, 6 put to left)

Step. 6 : 1368421 (6 × 2 =12,+1 = 13, 1 carried over, 3 put to left)

Step. 7 : 7368421 (3 × 2, = 6 +1 = 7, put to left)

Step. 8 : 147368421 (as in the same process)

Step. 9 : 947368421 (Do - continue to step 18)

Step. 10 : 18947368421

Step. 11 : 178947368421

Step. 12 : 1578947368421

Step. 13 : 11578947368421

Step. 14 : 31578947368421

Step. 15 : 631578947368421

Step. 16 : 12631578947368421

Step. 17 : 52631578947368421

Step. 18 : 1052631578947368421

Now from step 18 onwards the same numbers and order towards left continue.

Thus 1 / 19 = 0.052631578947368421

Find the recurring decimal form of the fractions 1 / 29, 1 / 59, 1 / 69, 1 / 79, 1 / 89 using Ekadhika process

Nikhilam Navatas'charamam Dasatah

The formula simply means: "all from 9 and the last from 10".

The formula can be very effectively applied in multiplication of numbers, which are nearer to bases like 10, 100, 1000 i.e., to the powers of 10(eg: 96 × 98 or 102 × 104). The procedure of multiplication using the Nikhilam involves minimum number of steps, space, time saving and only mental calculation. The numbers taken can be either less or more than the base considered.

Case (i) : when both the numbers are lower than the base.

Find 97 × 94. Here base is 100. Now following the rules, the working is as follows: 97 is 3 less than the nearest base 100. and 94 is 6 less than the same nearest base 100. Hence 3 and 6 are called deviations from the base. Always the base should be same for the two numbers.

$$\begin{array}{ll} \quad 97 & \quad 03 \\ \quad 94 & \quad 06 \\ \hline (97-06)\text{or} & \\ & (3\times 6) \quad =91/18=9118 \\ (94-03) & \end{array}$$

Note: Here '/' signifies just a seperation and has nothing to do with division.

In genreal, let N1 and N2 be two numbers near to a given base in powers of 10, and D1 and D2 are their respective deviations from the base. Then N1 X N2 can be represented as:

$$\begin{array}{ll} \quad \text{N1} & \quad \text{D1} \\ \quad \text{N2} & \quad \text{D2} \\ \hline (\text{N1}+\text{D2})\text{or} & \\ & (\text{D1}\times\text{D2}) \\ (\text{N2}+\text{D1}) & \end{array}$$

Case (ii) : When both the numbers are higher than the base.

The method and rules follow as they are. The only difference is the positive deviation. Instead of cross - subtract, we follow cross - add.104 X 102. Base is 100.

$$\begin{array}{ll} 104 & 04 \\ 102 & 02 \\ \hline 106/4\times 2 & =10608 \end{array}$$

Note: We are considering 04x02=08 and appending '08' and not just '4x2=8'. This is done because, we need to consider two digits in deviation as it the base 100 has two zeros. If the deviation is near 1000 then we need to consider 3 digits in the deviation (eg, 004 and not just 4).

Case (iii): One number is more and the other is less than the base.

In this situation one deviation is positive and the other is negative.

So the product of deviations becomes negative. So the right hand side of the answer obtained will therefore have to be subtracted. To have a clear representation and understanding a vinculum is used. It proceeds into normalization. 13 × 7. Base is 10

$$\begin{array}{lll} 13 & 03 & \\ 7 & -03 & \\ \hline (13-03)\text{or} & & \\ & 03\times -03 & = 10/\text{-}09 = 91 \\ (7+30) & & \end{array}$$

10/(-9) = 91 how?

10/(-9) should be read as 'one zero, nine bar'. Here 'one' and 'zero' are in normal form. 'nine' is in complement form, so, when we bring a carry from normal form to complement form, '10' becomes '9' and '9-bar' becomes '1'(10's complement of 9). Hence 10/(-9)-91.

Another example would be 94/(-3) = 93/7 = 937.

Find the following products by Nikhilam formula.

1) 7 × 4
2) 93 × 85
3) 875 × 994
4) 1234 × 1002
5) 1003 × 997
6) 11112 × 9998
7) 1234 × 1002
8) 118 × 105

Anurupyena

The upa-Sutra 'Anurupyena' means 'proportionality' or 'similarly'. This Sutra is highly useful to find products of two numbers when both of them are near the Common bases like 50, 60, 200 etc(multiples of powers of 10).

EXAMPLE 1:

46 × 43

As per the previous methods, if we select 100 as base we get

$$\begin{array}{ll} 46 & -54 \\ \underline{43} & \underline{-57} \end{array}$$

This is much more difficult and of no use.

Now by 'Anurupyena' we consider a different working base through we can solve the problem.

Take the nearest higher multiple of 10. In this case it is 50.

Treat it as 100 / 2 = 50.

Now the steps are as follows:

i) Choose the working base near to the numbers under consideration.

i.e., working base is 100 / 2 = 50

ii) Write the numbers one below the other

46

43

iii) Write the differences of the two numbers respectively from 50 against each number on right side

46 –04

43 –07

iv) Write cross-subtraction or cross- addition as the case may be under the line drawn. Multiply the differences and write the product in the left side of the answer.

$$\begin{array}{l|l} 46 & -04 \\ 43 & -07 \\ \hline (46-07) \text{ or } (43-04) & -04\times07 \\ \hline =39 & 28 \end{array}$$

v) Since base is $100/2=50$, 39 in the answer represents 39×50.

Hence divide 39 by 2 because 50 = 100 / 2

Thus 39 ÷ 2 gives 19½ where 19 is quotient and 1 is remainder . This 1 as Reminder gives one 50 making the L.H.S of the answer 28 + 50 = 78(or Remainder ½ x 100 + 28) i.e. R.H.S. 19 and L.H.S. 78 together give the answer 1978.

We represent it as

46 -04

43 -07

2) 39 / 28

19.5 / 28

= 19 / (50 + 28)

= 19 / 78 = 1978.

Solve 58 × 48 :

Working base 50 = 5 × 10 gives

$$\begin{array}{l} \quad 58 \quad 08 \\ \quad 48 \quad -02 \\ \hline 2)\ 56\ /\ -16 \\ \hline \quad 28\ /\ -16 \\ \hline \quad 27/(100\ -\ 16) \\ =\ 27\ /\ 84 \\ \hline =\ 1978. \end{array}$$

Find the following products.

1. 46 × 46
2. 57 × 57
3. 54 × 45

Urdhva Tiryagbhyam

Urdhva - tiryagbhyam is the general formula applicable to all cases of multiplication and also in the division of a large number by another large number. It means "Vertically and cross wise."

Multiplication of two 2 digit numbers.

EXAMPLE 1:

Find the product 14 × 12

The symbols are operated from right to left .

Step (i) :

$$\begin{array}{cc} 1 & 4 \\ 1 & 2\downarrow \\ \hline : & 4\text{x}2 \end{array}$$

Step (ii) :

$$\begin{array}{ccc} 1 & & 4 \\ & \times & \\ 1 & & 2 \\ \hline 2+4 & : & 8 \end{array}$$

Step (iii) :

$$\begin{array}{cc} \downarrow 1 & 4 \\ 1 & 2 \\ \hline 1\text{x}1:6 & :8 \end{array}$$

which gives 168

Let us work another problem by placing the carried over digits under the first row and proceed.

$$\begin{array}{lr} & 234 \\ & \times \quad 316 \\ \hline & 61724 \\ 1222 & \text{——— carry} \\ \hline & 73944 \end{array}$$

Steps:

(i) 4 × 6 = 24 : 2, the carried over digit is placed below the second digit.

(ii) (3 × 6) + (4 × 1) = 18 + 4 = 22 ; 2, the carried over digit is placed below third digit.

(iii) (2 × 6) + (3 × 1) + (4 × 3) = 12 + 3 + 12 = 27 ; 2, the carried over digit is placed below fourth digit.

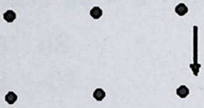
(iv) (2 × 1) + (3 × 3) = 2 + 9 = 11; 1, the carried over digit is placed below fifth digit.

(v) (2 × 3) = 6.

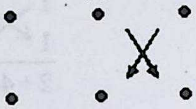
(vi) Respective digits are added.

General rule for a 3 digit by 3 digit multiplication:

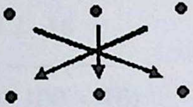
(1)



(2)



(3)



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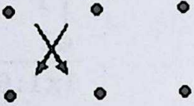

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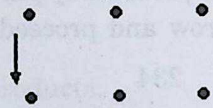


Adyamadyena-Antyamantyena

The Sutra ' Adyamadyena-Antyamantyena' means 'the first by the first and the last by the last'.

Suppose we are asked to find out the area of a rectangular card board whose length and breadth are respectively 6ft . 4 inches and 5 ft. 8 inches. Generally we continue the problem like this.

Area = Length × Breath

By Vedic principles we proceed in the way "the first by first and the last by last"

i.e. 6' 4" can be treated as $6x + 4$ and 5' 8" as $5x + 8$,

Where x = 1ft. = 12 in; x^2 is sq. ft.

Now $(6x + 4)(5x + 8)$

$= 30x^2 + 6.8.x + 4.5.x + 32$

$= 30x^2 + 45x + 20x + 32$

$= 30x^2 + 68.x + 32$

$= 30x^2 + (5x + 8).x + 32$

Writing 68 = 5 × 12 + 8

$= 35x^2 + 8x + 32$

= 35 sq. ft. + 8 × 12 sq. in + 32 sq. in

= 35 sq. ft. + 96 sq. in + 32 sq. in

= 35 sq. ft. + 128 sq. in.

It is interesting to know that a mathematically untrained and even uneducated carpenter simply works in this way by mental argumentation. It goes in his mind like this

6' 4"

5' 8"

First by first i.e. 6' × 5' = 30 sq. ft.

Last by last i.e. 4" × 8" = 32 sq. in.

Now cross wise 6 × 8 + 5 x 4 = 48 + 20 = 68.

Adjust as many '12' s as possible towards left as 'units' i.e. 68 = 5 × 12 +8 , 5 twelve's as 5 square feet make the first 30+5 = 35 sq. ft ; 8 left becomes 8 x 12 square inches and go towards right i.e. 8 × 12 = 96 sq. in. towards right ives 96+32 = 128sq.in.

Thus he got area in some sort of 35 squints and another sort of 128 sq. units.

i.e. 35 sq. ft 128 sq. in

ANOTHER EXAMPLE:

4' 6"

3' 4"

---

4 × 3 =12	4×4+6×3 =16 + 18 = 34 = 2×12+10	6×4 = 24

Now 12 + 2 = 14, 10 x 12 + 24 = 120 + 24 = 144

Thus 4' 6" × 3' 4" = 14 Sq. ft. 144 Sq. inches.

Since 144 sq. in = 12 × 12 = 1 sq. ft .

The answer is 15 sq. ft.

Sankalana-Vyavakalanabhyam

This Sutra means 'by addition and by subtraction'. It can be applied in solving a special type of simultaneous equations where the x - coefficients and the y - coefficients are found interchanged.

EXAMPLE 1:

$45x - 23y = 113$

$23x - 45y = 91$

From Sankalana - vyavakalanabhyam

add them,

i.e., $(45x - 23y) + (23x - 45y) = 113 + 91$

i.e., $68x - 68y = 204$ i.e., $x - y = 3$

subtract one from other,

i.e., $(45x - 23y) - (23x - 45y) = 113 - 91$

i.e., $22x + 22y = 22$ i.e., $x + y = 1$

and repeat the same sutra, we get $x = 2$ and $y = - 1$

EXAMPLE 2:

$1955x - 476y = 2482$

$476x - 1955y = -4913$

Oh ! what a problem ! And still

just add, $2431(x - y) = - 2431$ i.e., $x - y = -1$

subtract, $1479 (x + y) = 7395$ i.e., $x + y = 5$

once again add, $2x = 4$ $x = 2$

subtract $- 2y = - 6$ $y = 3$

Solve the following problems using Sankalana - Vyavakalanabhyam.

1. $3x + 2y = 18$

   $2x + 3y = 17$

2. $5x - 21y = 26$

   $21x - 5y = 26$

Yavdunam Taavdunikritya Vargancha Yojayet

This sutra means whatever the extent of its deficiency, lessen it still further to that very extent; and also set up the square of that deficiency. This sutra is very handy in calculating squares of numbers near(lesser) to powers of 10

For instance in computing the square of 98 we go through the following steps:

1. The nearest power of 10 to 98 is 100.
2. Therefore, let us take 100 as our base.
3. Since 98 is 2 less than 100, we call 2 as the deficiency.
4. Decrease the given number further by an amount equal to the deficiency.

   i.e., perform (98 -2) = 96. This is the left side of our answer!!.
5. On the right hand side put the square of the deficiency, that is square of 2 = 04.
6. Append the results from step 4 and 5 to get the result. Hence the answer is 9604.

Note: While calculating step 5, the number of digits in the squared number (04) should be equal to number of zeroes in the base(100). Hence in our case, the base 100 has 2 zeros and hence sqaure of 2 is 04 and not just 4.

Now consider another example: Calculate the square of 94. (following the steps given above...)

1. The neareset power of 10 to given number 94 is 100

2. Hence the base is 100
3. Deficiency = 6
4. Subtract the deficiency from the given number (94 - 6) = 88
5. Square of deficiency = 36 (2 digits)
6. Append the results from step 4 and 5 to get the result. i.e., 8836

Try out calculating squares of 96, 994, 9999995

Yavadadhikam Taavadahikikritya Vargancha Yojayet

This sutra means whatever the extent of its surplus, increment it still further to that very extent; and also set up the square of that surplus. This sutra is very useful in calculating the sqaures of numbers nearer(greater) to powers of 10.

For instance: in computing the square of 103 we go through the following steps:

1. The nearest power of 10 to 103 is 100.
2. Therefore, let us take 100 as our base.
3. Since 103 is 3 more than 100(base), we call 3 as the surplus.
4. Increase the given number further by an amount equal to the surplus.

   i.e., perform (103 + 3) = 106.

   This is the left side of our answer!!.
5. On the right hand side put the square of the surplus, that is square of 3 = 09.
6. Append the results from step 4 and 5 to get the result.

Hence the answer is 10609.

Note: while calculating step 5, the number of digits in the squared number (09) should be equal to number of zeroes in the base(100). Hence in our case, the base 100 has 2 zeros and hence sqaure of 3 is 09 and not just 9.

Similarly if we need to calculate the square of 1009,

1. The nearest power of 10 to 1009 is 1000.
2. Therefore, let us take 1000 as our base.
3. Since 1009 is 9 more than 1000(base), we call 9 as the surplus.
4. Increase the given number further by an amount equal to the surplus.

   i.e., perform (1009 + 9) = 1018. This is the left side of our answer!!.
5. On the right hand side put the square of the surplus, that is square of 9 = 081.(not just 81 !)
6. Append the results from step 4 and 5 to get the result.

Hence the answer is 1018081.

Try to find the square of 106 and 19 using this sutra.

Now here's a twist. What is sqaure of 112 using this rule? will this rule apply?

Answer is Yes. But we need to stick to basics and use some common sense.

Here we go...

1.&2. the base is 100.

3. Surplus = 12
4. Increase the given number by surplus i.e. (112 + 12) = 124
5. Square of surplus, 12 = 144 . Now what?

   by rule we need to consider only 2 digits in step 5 (as the base has 2 zeros)

6. We have to append 124 and 144. The '1' in 144 becomes 'carry' to 124.

Hence the result is (124 +1) appended with 44 i.e., 12544 is the result.

Dont get confused. try this example to make yourself more confident.

Find the square of 111. Now try to find the square of 10101.

Antyayor Dasake'PI

The Sutra simply means - numbers of which the last digits added up give 10.

This sutra is helpful in multiplying numbers whose last digits add up to 10(or powers of 10). The remaining digits of the numbers should be identical.

i.e. the Sutra works in multiplication of numbers for example:

25 and 25, 2 is common and 5 + 5 = 10

47 and 43, 4 is common and 7 + 3 = 10

62 and 68,

116 and 114.

and also for 425 and 475

The last example can be looked as digit 4 being common and 25 and 75 add upto 100.

Note that in each case the sum of the last digit of first number to the last digit of second number is 10. Further the portion of digits or numbers left wards to the last digits remain the same.

At that instant use Ekadhikena on left hand side digits. Multiplication of the last digits gives the right hand part of the answer.

EXAMPLE 1 :

57×53

See the end digits sum $7 + 3 = 10$; then by the sutras Antyayor dasakepi and Ekadhikena we have the answer.

Ekadhikena to the remaining digits means, increment the remaining digits by 1 and multiply it with the same.

$57 \times 53 = (5 + 1) \times 5 / 7 \times 3$ (the '/' is just a seperator and not a division mark) = 30 / 21

= 3021.

EXAMPLE 2:

62×68

$2 + 8 = 10$, L.H.S. portion remains the same i.e., 6.

Ekadhikena (increment) of 6 gives 7

$62 \times 68 = (6 \times 7) / (2 \times 8)$

$= 42 / 16$

$= 4216.$

Use Vedic sutras to find the products

1. 125 × 125
2. 34 × 36
3. 98 × 92

It is further interesting to note that the same rule works when the sum of the last 2, last 3, last 4 - - - digits added respectively equal to 100, 1000, 10000 -- - - . The simple point to remember is to multiply each product by 10, 100, 1000, - - as the case may be . Your can observe that this is more convenient while working with the product of 3 digit numbers.

Eg. 1: 292 × 208

Here 92 + 08 = 100, L.H.S portion is same i.e. 2

292 × 208 = (2 x 3) / 92 x 8

= 60 / 736 (for 100 raise the L.H.S. product by 0)

= 60736.

Find the following products using 'Antyayordasakepi'

1. 318 × 312
2. 425 × 475

Lopana Sthapanabhyam

Lopana sthapanabhyam means 'by alternate elimination and retention'.

Consider the case of factorization of quadratic equation of type $ax^2 + by^2 + cz^2 + dxy + eyz + fzx$. This is a homogeneous equation of second degree in three variables x, y, z. The sub-sutra removes the difficulty and makes the factorization simple. The steps are as follows:

i) Eliminate z by putting z = 0 and retain x and y and factorize thus obtained a quadratic in x and y by means of Adyamadyena sutra.

ii) Similarly eliminate y and retain x and z and factorize the quadratic in x and z.

iii) With these two sets of factors, fill in the gaps caused by the elimination process of z and y respectively. This gives actual factors of the expression.

EXAMPLE 1 :

$3x^2 + 7xy + 2y^2 + 11xz + 7yz + 6z2$.

Step (i) : Eliminate z and retain x, y; factorize

$3x^2 + 7xy + 2y^2 = (3x + y)(x + 2y)$

Step (ii) : Eliminate y and retain x, z; factorize

$3x^2 + 11xz + 6z^2 = (3x + 2z)(x + 3z)$

Step (iii): Fill the gaps, the given expression

$= (3x + y + 2z)(x + 2y + 3z)$

EXAMPLE 2 :

$$3x^2 + 6y^2 + 2z^2 + 11xy + 7yz + 6xz + 19x + 22y + 13z + 20$$

Step (i) : Eliminate y and z, retain x and independent term i.e., $y = 0$, $z = 0$ in the expression (E).

Then $E = 3x^2 + 19x + 20 = (x + 5)(3x + 4)$

Step (ii) : Eliminate z and x, retain y and independent term i.e., $z = 0$, $x = 0$ in the expression.

Then $E = 6y^2 + 22y + 20 = (2y + 4)(3y + 5)$

Step (iii): Eliminate x and y, retain z and independent term i.e., $x = 0$, $y = 0$ in the expression.

Then $E = 2z^2 + 13z + 20 = (z + 4)(2z + 5)$

Step (iv) : The expression has the factors (think of independent terms: constants)

$= (3x + 2y + z + 4)(x + 3y + 2z + 5)$.

Solve the following expressions into factors by using appropriate sutras:

1. $x^2 + 2y^2 + 3xy + 2xz + 3yz + z^2$.
2. $3x^2 + y^2 - 4xy - yz - 2z^2 - zx$.

Gunita Samuccayah—Samuccaya Gunitah

In connection with factorization of quadratic expressions a sub-Sutra, viz. 'Gunita samuccayah-Samuccaya Gunitah' is useful.

It is intended for the purpose of verifying the correctness of obtained answers in multiplications, divisions and factorizations.

It means in this context: 'The product of the sum of the coefficients(sc) in the factors is equal to the sum of the coefficients(sc) in the product'

Symbolically we represent as sc of the product = product of the sc (in the factors)/p>

EXAMPLE 1:

$(x + 3)(x + 2) = x^2 + 5x + 6$

Now $(x + 3)(x + 2) = 4 \times 3 = 12$: Thus verified.

EXAMPLE 2:

$(x + 5)(x + 7)(x - 2) = x^3 + 10x^2 + 11x - 70$

$(1 + 5)(1 + 7)(1 - 2) = 1 + 10 + 11 - 70$

i.e., $6 \times 8 \times -1 = 22 - 70$

i.e., $-48 = -48$ Verified.

Verify whether the following factorization of the expressions are correct or not by the Vedic check:

i.e. Gunita. Samuccayah-Samuccaya Gunitah:

1. $(2x + 3)(x - 2) = 2x^2 - x - 6$
2. $12x^2 - 23xy + 10y^2 = (3x - 2y)(4x - 5y)$
3. $12x^2 + 13x - 4 = (3x - 4)(4x + 1)$
4. $(x + 1)(x + 2)(x + 3) = x^3 + 6x^2 + 11x + 6$

Veni, Vedic, Vedic

The ancient science of Vedic mathematics may well give calculators a run for their money.

Does your mind wobble when confronted by a mathematical challenge more forbidding than two plus two? Do you dream of becoming the kind of person who can rattle off answers to the most complicated sums in the fraction of a second?

If the answer is yes, you need Vedic mathematics. Try this for size. What's the square of 65? Simple: just multiply the first digit, 6, with its successor, 7.

The answer is 42. Now find the square of the second digit, five, which is 25. Now bring the two together. Bingo, the answer is 4225! Don't believe it? Try it out with any two digit odd number divisible by five.

The law behind this apparent magic is the nikhilam sutra, one of the sutras or formulae that compose Vedic mathematics. These sutras were part of the parisista (appendix) of the Atharva Veda. "Our Vedas are the original source of knowledge. Vedic mathematics," says Dr. Narendra Chaudhury, "is one such source." A geology professor at Nagpur University in western India, Chaudhury turned to Vedic mathematics after attending a conference organized by the Einstein Foundation in 1984. Introduction to Vedic mathematics is like entering Alice's wonderland, where logic is turned on its head. Division is by a process of multiplication and addition, and multiplication is done by cross-subtraction. Nothing makes sense, but everything works. And the simplicity of the approach exposes top-heavy processes of our logic-driven world.

Unlike conventional mathematics, Vedic mathematics is not linear. Here, it would be as easy to multiply 432567 with 754352 as it would be to multiply four into five. This is because the processes are governed by an internal relationship between numbers rather than by external methods of conventional mathematics. Another distinguishing characteristic of Vedic mathematics is its holistic approach. Numbers are not separated from their philosophical and spiritual contexts. Number one stands for the Absolute, and therefore it cannot be subtracted or divided. Two represents unmanifest nature and three manifest nature. Four is associated with the world of mind and feeling. Number five represents ether and has the quality of sound. Six is air and possesses the quality of touch. Fire is at seven and water at eight. Finally, nine is represented by earth. Such an intimate relationship between numbers and the elements of the universe creates a unified body of knowledge that is far easier to follow than the fragmentary western way. To keep things simple, Vedic mathematics constantly reiterates that there are only nine numbers and a nought, and everything else derives from these.

Vedic mathematics, as it is found today, was formulated by the late Bharti Kishan Tirthaji, the Shankaracharya of Puri, a seaside temple town in the eastern Indian state of Orissa. He introduced 32 sutras through a study of the ancient texts, coupled with an insight into the nature of numbers. There are 16 main sutras and 16 sub-sutras. Application of the sutras depends on the problem: Vedic mathematics provides more than a way of solving a problem-the easiest is the best. Chaudhury rues the general ignorance shrouding Vedic mathematics. "The main reason," he says, "is the low awareness and the lack of an efficient faculty. Nobody will appreciate it unless the topic is made interesting." To make Vedic mathematics more accessible, it is necessary for the subject to be included in school curricula. Making learning fun is an oft-voiced concern. The means lie in ancient wisdom-which is ours to use or throw!

Addition

$6932 + 1803 + 3331 = 1206$

This can be cross-checked in the following manner:

(i) $6 + 9 + 3 + 2 = 20 = 2(2 + 0)$

(ii) $1 + 8 + 0 + 3 = 12 = 3(1 + 2)$

(iii) $3 + 3 + 3 + 1 = 10 = 1(1 + 0)$

(iv) $2 + 3 + 1 = 6$

(v) $1 + 2 + 0 + 6 + 6 = 15 = 6(1 + 5)$

Steps (iv) and (v) contain the same digit and that is 6. So the solution is accurate.

Vertical and Crosswise Multiplication

The conventional method of multiplying

24 into 36 would go like this: 24

$\underline{\times\ 36}$ 144

$\underline{72}$ 864

The Vedic method will work out the sum thus:

24 is the multiplicand and

36 is the multiplier *Step 1 Vertical multiplication*

Multiply the left-most of the multiplicand, in this case 2 24 with the leftmost digit of the multiplier, in this case 3 × 36

So, 2 × 3 = 6 6 *Step*

2 Crosswise multiplication Multiply the first digit of the multiplicand, in this case 2 with the second digit of the multiplier, in this case 6 So, 2 × 6 = 12

Now, multiply the second digit of the multiplicand, in this case 4 with the first digit of the multiplier, in this case 3 So, 4 × 3 = 12

Add the two products: 12 + 12 = 24

24 Place the second digit of the total next to the result of x36 step 1 and carry 2 to the next line 64 2 Step 3

Vertical multiplication Multiply the right-hand digits multiplicand and 24 multiplier.

4 × 6 = 24 × 36

Place 4 at the right hand most of the answer 644 and carry 2 to the next line + 22 Final result: 864

Vedic Mathematics

Rapid Mental Calculation

Galactic Mathematics Rediscovered: Jain will give you an understanding of the 16 basic Sutras or 'Word Formula' which can solve all known mathematical problems by using an ancient yet simple system of MENTAL, ONE LINE ARITHMETIC,used extensively by the Hindus more than 2,500 years ago.

The knowledge goes even further back. Jain calls this modality, Galactic Mathematics which is base 12.

During this day you will learn how to multiply 3 digit numbers in your head with no calculator, pen or paper.

How could the Aryan civilisation, near the Hunza Valley, 3,000 years ago, mentally compute mathematical operations that today only a calculator could achieve?

Jain wrote an article: VEDIC MATHEMATICS REDISCOVERED for the Nexus Magazine, Oct/Nov issue 2003. He shows how an understanding of the 16 basic Sutras or 'Word Formula' solves all known mathematical problems by using an advanced and highly intelligent system of MENTAL, ONE LINE ARITHMETIC used by the Hindus more than 2,000 years.

From response all over the world, this article has awakened many people to start questioning all the missing gaps and insufficiencies in the current mathematics curriculum.

If you or your children can't understand the fragmented and confusing mathematical data taught today? Would you be interested in another method that boosts confidence,increases memory skills... and is presented in a fun and exciting manner?

After this program, you will never multiply, divide or add in the same manner again. And no more Times Tables!

In this workshop you will know how to accomplish rapid calculations, mentally. No more Calculators which make the brain lazy. The brain is a mental muscle and needs to be exercised.

Jain predicts that "if we continue to teach children with an over-emphasis of using calculators in the class-room, over a 20 year period, then no doubt, the Global Brain will deteriorate". We pride ourselves that we are a highly intelligent species, but really, are we getting dumber.

Most young people are visual and the ability to tap into 'Pattern Recognition' is the key to rapid mental calculation.

"Jain he is an absolute wizard at displaying the real ability of your mind as he empowers students to perform mental calculations, in many cases... quicker than a calculator. Yes you did hear right! Jain reveals to you simple methods to mentally calculate all the complex math you can think of. At the same time he shows you how the world as we know it is more than we think it is".

Vedic Mathematics Rediscovered

Some questions to ponder upon:

- How could the Aryan civilization, near the Hunza Valley, 3,000 years ago, mentally compute mathematical operations that today only a calculator could achieve?
- And if the mathematics could not be done mentally, how could they do everything we know today, IN ONE-LINE? eg: converting the fraction 1/19 into a decimal is an 18 digit answer that requires 35 lines of exhausting long division, how could they do it in a one simple line solution?
- Why is NASA secretly using this MENTAL, ONE-LINE SYSTEM OF ARITHMETIC in the field of Advanced Artificial Intelligence? and not incorporating it into our current mathematics curriculum?
- Why are many of Bill Gate's Mathematicians Indians?
- Is the decimal form of Pi (3.141592) a sonic code for dedications to Krishna?
- What does the Bhagavad Gita have to say about this lost science of Clairvoyant Calculation that the ancient Temple Builders employed?
- How can you become a Human Bio-Calculator?
- Is the current Western Mathematics Curriculum keeping our Children in a state of limited intelligence?

The answers to all these questions are found by understanding the ancient system of Vedic Mathematics as rediscovered by Bharati Krsna Tirthaji (1884-1960), of Puri Govardhan Math, dux of India in Mathematics and a Sanskrit Philosopher who wrote and spoke perfect English, he reached the position of a Shankacharya (the spiritual head of India 100 years ago, like a Dalai Lama or Vatican Pope), renunciated several high official positions in society to retreat into a forest for 7 years as a yogi, between 1911 and 1918 in which time he collected all the lost mathematical knowledge (Ganita Sutras), improved and reconstructed them to 16 basic Sutras or word formulae that solve every known mathematical problem. These 16 Volumes relating to the 16 Sutras was our legacy from the ancient past.

This highly intelligent and sophisticated system of Mental, One-Line Arithmetic was taught by The Master to his main student, who today is the leading exponent in the world: Maharishi Mahesh Yogi, the long white-haired and bearded yogi that many of the 60s generation know of as the Beatle's guru. He is considered as the greatest human bio-calculator on the planet today, holding the vision of raising the collective consciousness of all nations by re-introducing the lost Vedic Mathematics Sutras early in a child's spiritual and educational development. Imagine a maths class in India today, like in the times of old when knowledge was passed on as an oral tradition, and the teacher quickly calls or drills out certain numbers to multiply or divide and the children instantly reply with the correct intuitive answers! Today, in schools where Maharishi's Transcendental Meditation technique are used students perform remarkably well academically, viewing Mathematics as a Universal Language and therefore often winning the highest competitive prizes in mathematics.

Maharishi organized the scattered Vedic Literature into a complete science of consciousness for both its theoretical and practical value, describing the 16 Sutras as fundamental impulses of intelligence that structure all the Laws of Nature and those that govern the Universe.

Maharishi, the Founder of TM, once said:

> *"Vedic Mathematics is that one field of knowledge which fulfils the purpose of education by developing the total creative genius of the individual, giving him / her the ability to be always spontaneously right and automatically precise so that his / her action, supported by Natural Law, is always effortlessly fulfilling."*

Unfortunately, all of Bharati Krsna's 16 Volumes for the 16 Sutras were confirmed lost in 1958 after Bharati Krsna Tirthaji returned from the USA tour, sponsored by the Self-Realization Foundation: the successors of Paramahansa Yogananda (who died in 1952, and who introduced Yoga to the West). Disciples observed that people in the streets of India were imitating Tirthaji's lectures and dazzling audiences with mathematically mis-used psychic powers, and begged the Master to write a book just before his death in 1960. This single volume, called VEDIC MATHEMATICS, has become the bible on this subject and spawned a thousand web-sites worldwide. Maharishi schools disseminated the teachings to England where certain schools have adopted the Vedic curriculum but the irony is that today India is struggling to release the British curriculum and NASA have adopted it fully in the realms of advanced robotics. Calculations that can be solved as quick as lightning are a great tool to adopt, but you wouldn't want to teach it worldwide in the fear that you may churn out a generation of child geniuses that may threaten the intellectual status quo.

The gift that the Hindus gave to world, thousands of years ago, and that which is currently responsible for global silicon chip technology, was none other than the invention of ZERO and the use of the decimal point. We call our common numbers "Arabic Numerals" but really they extend back to the Hindu concept of creation and void known as "Bindu" or The Zero Point. In Maths, it makes the magic work eg: if you wish to multiply 98 x 98 we need to understand Zero and Unity. All Vedic Maths is based on the understanding of Unity Consciousness which means they utilize processes or Number Bases that correspond to:

0, 10, 100, 1000, 10000 etc. all of which add to 1.

Let us look at some practical examples, in light of the fact that the Vedas, literally "the illimitable storehouse of All Knowledge" came under 4 headings or categories like Ayurveda (Healing), and Vedas for Music and Astronomy etc. and one relevant sub-Veda that related to Temple Building and Engineering and therefore Mathematics called Sthapathyaveda. Thus a Vedic Mathematician was also an astronomer, healer and poet. It was a total system. As a temple builder, there was no pen and paper, you simply calculated in your head. You are out in the field and you need to tile a square floor that is, say 108 units square. How do you do it with mental ease?

I think only of the excess "8", saying how much is 108 more than my Base of 100. It is "8". So I will merely add this "8" to the number in question "108" and tag on the squaring of this excess:

108 Squared = 108 + 8 / 8 × 8

= 116 / 64 = 11,664

Its very simple.

Here is another Mental, One-Line Calculation:

Sutra: By the Excess

The Multiplication of Numbers Over a Base

108 × 109 can be computed in one second by understanding this Pattern Recogition:

I add the excess of "8" to the other number "109" and then tag on the multiplicatin of those two excesses: "8" and "9".

108 × 109 = 109 + 8 / 8 x 9

= 117 / 72

= 11,772

Sutra: By the Deficiency

The Squaring of Numbers Under a Base

To solve 98 Squared (98 x 98) we must first determine what Base we are in. It is close to 100, therefore we say Base 100. We must now choose one of the 16 Sutras to effectively solve the problem. It is called: "By The Deficiency":

> *"By whatever the deficiency, lessen it further by that much and set up the square thereof"*

says one of the 16 Sutras. Sounds cryptic and meaningless yet it quickly solves the problem.

We get our answer by merely knowing how much is 100 less 98. Knowing that the deficiency is 2, we merely lessen 98 by 2 and then we tag on the squaring of that 2. As a one-line answer, the setting out would appear as thus:

98 Squared = 98 - 2 / 2 × 2. Simplifying it:

= 96 / _ 4

We almost have our answer. What we need to know is that since our Base is 100, it has 2 zeroes, therefore this fact governs the need for 2 spaces or 2 digits after the "forward slash" symbol (/). By inserting or inventing The Zero as a "Place Marker", the answer is achieved:

98 Squared = 96 / 04

= 9,604.

(Perhaps the greatest invention of all time, the Hindu creation of the Zero was to change the world unimaginably as time passed on leading to the ability to send Vimana U.F.O craft and rockets into space, to supercomputers and thus the ancient and continuing battle between Michael and Lucifer:

> *Archangel Michael's Internal Light Vehicle Merkabah Time/Space Travel and Natural Spiritual Powers Versus Lucifer's daring invention of the External Merkabah or Artificial Technological Metal Spacecraft).*

Observe similar examples:

97 Squared = 97 - 3 / 3 × 3
= 94 / 09

96 Squared = 96 - 4 / 4 × 4
= 92 / 16.

What if we enlarged our numbers to 998 Squared?

It is close to 1,000 so we say Base 1,000 and know to have 3 zeroes on the right hand side of the (/).

998 Squared= 998 - 2 / 2 × 2
= 996 / _ _ 4
= 996 / 004.
= 996,004

Understanding this, you can be calculating digits in the millions:

9998 Squared = 9998 - 2 / 2 × 2
= 9996 / _ _ _ 4

(Since we are in Base 10,000 the 4 Zeroes determine the need for 4 digits after the (/).

= 9996 / 0004
= 99,960,004.

There is a world-wide debate currently raging about the efficacy of Vedic Mathematics versus the crumbling foundations of Western Mathematics.

Generally speaking, the theorems we all learned at school are not wrong but clumsy. Some of the Western geometrical formulae are certainly wrong or inadequate: for example, the formulae for sphere packing in the higher dimensions increase up to the 6th Dimension then suddenly decrease for higher dimensions, which is simply absurd.

Unfortunately, some die-hard senior mathematicians in an attempt to protect the crumbling foundations that they now stand on feel threatened by the lightning quick mental calculations of the Vedic seers, and go to great lengths to deride Vedic maths as a "bag of tricks". And of course, many insecure teachers worldwide are afraid to rewrite all their course material.

Here is another example illustrating its utter simplicity:

"The Path of Least Resistance", or "The Law of Economy".

Sutra: By one More

The Squaring of Numbers Ending in 5

If we wanted to square the number 25, i.e. 25 x 25, we would conventionally take 3 lines of working out. Vedic Mathematics merely looks at the Question, applies one of the 16 Sutras, and solves it Mentally in One-Line. In this case, the Sutra at work is "By One More Than The Previous Digit". Observing that 25 is a 2 digit number, 5 is the last digit, but we are mainly interested in "the Previous Digit" which is 2. We say, mentally, "What is One more than Two?" It is 3. The word "By" in the Sutra really means "to multiply". The setting out for the first half of the answer is thus:

25^2 = 2 "By" 3 / ....

= 2 × 3 / ....

To this we tag on the last digit "5" squared:

$$= 2 \times 3 \ / \ 5 \times 5 = 6 \ / \ 25$$

Thus the answer is 625.

Similarly, all other numbers that end in 5, when squared, can be done instantly:

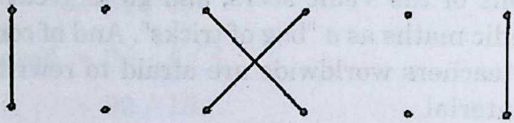
$15^2 = 1 \times 2 \ / \ 5 \times 5 = 2 \ / \ 25 = 225$

$35^2 = 3 \times 4 \ / \ 5 \times 5 = 12 \ / \ 25 = 1{,}225$

$45^2 = 4 \times 5 \ / \ 5 \times 5 = 20 \ / \ 25 = 2{,}025$

$95^2 = 9 \times 10 \ / \ 5 \times 5 = 90 \ / \ 25 = 9, 025$

Sutra: Vertically and Crosswise:



Sutra: Vertically and Crosswise

Here is another simple Sutra, the one that Bharati Krsna Tirthaji refers to as most widely used, called "Vertically and Crosswise" and solves all multiplication by application of a pattern (which is registered by the Right Brain as Feminine-Natured Mathematics in contrast to the logical Male Left Brain style of moths you learnt at school).

eg: To find 26 Multiplied by 31 in One-Line, we need to look at a Pattern,

viz: This Sutra, known as: "Vertically and Crosswise" shows we will have a 3-Digit Answer represented by the 3 short horizontal lines.

Here is how we traditionally write the setting out for "26 × 31":

2 6
×
3 1

Notice there are 4 digits involved (2, 6, and 3, 1) and let them be represented by a small circle or dot and that explains the format seen in Fig. This will help you to understand "CROSS ADDITION" which is shown as the middle part:

[(2 × 1) + (6 × 3)] and uses both multiplication and addition in the form of the letter "X" and corresponds to the "cross-over of the optical nerve in the brain" shown in Fig 137e below. (Here, the symbol "x" = Multiplication):

= 2 × 3 (2 × 1) + (6 × 3) 6 × 1

= 6 2 0 6

(nb: the "2" of the "20" is carried over to the left hand side).

= 8 0 6

= 806 (This shows only the mental workings. The Multiplication of 26 by 31 can be solved mentally!)

There are 16 Jaw-Dropping Sutras or simple Sanskrit Word Formulae which solve all known mathematical problems in the branches of Arithmetic, Algebra, Geometry and Calculus are easy to understand, easy to apply and easy to remember.

This Vedic One-Line Mental Arithmetic is very helpful in stimulating Modern Mathematicians to adopt its simplicity and quickness. Once initiated to these Vedic rules, students of all ages will appreciate and enjoy the enhanced subject.

The aim of Vedic Mathematics is to bring this long-hidden treasure trove of intelligent mathematical knowledge within easy reach of everyone who wishes to obtain it and benefit by it.

Sutra: Digital Sums—for Multiplication by Eleven

When scientists have a problem, say with electronic data, and they need to send it efficiently, the solution is invariably Compression. Digital Compression is a powerful Sutra that solves multiplication by 11 very quickly.

If we wanted to multiply 25 × 11 we merely add the two digits of the 25 and say "2 + 5" which is 7 and insert it between the two digits. Thus the answer is 275. Another way of showing this is to separate the two digits and insert their digital sum:

25 × 11 = 2 (2+5) 5
= 2 7 5
39 × 11 = 3 (3+9) 9
= 3 12 9

(nb, the "1" of the "12" gets carried over to the left)

= 429

Vedic Mathematics

Additional insights into the Hindutva perspective on science are provided by the track record of the four states captured by the BJP in the 1991 elections: Uttar Pradesh, Madhya Pradesh, Rajasthan and Himachal Pradesh. All four BJP State Governments introduced Vedic Mathematics (VM) into the school syllabus and intended to do the same in the syllabi of engineering colleges and polytechnics. Strangely, the sneaking of pseudo-science into publicly-funded education triggered very little debate in Indian scientific circles.

What is this `Vedic Mathematics'? It is somewhat difficult to define as the very terminology is used only by a small set of authors and a handful of mathematicians. The purveyors of `Vedic Mathematics' are agreed, however, that the landmark work in this ``discipline'' is the text ``Vedic Mathematics'', written by Jagadguru Swami Sri Bharathi Krishna Tirthaji Maharaja, Shankaracharya of Govardhan Matha, Puri (he died in 1960) and published in 1965

(Jagadguru, 1965). It is instructive to examine this text in some detail. The title page has the interesting sub-title, ``Sixteen Simple Mathematical Formulae from the Vedas (For one-line answers to all Mathematical Problems)." Passing through diverse prefatory remarks by various personalities (none of whom is a mathematician), we come to the author's preface, arranged in numbered paragraphs. After explaining the meaning of the word the `Veda' (paragraph 2), the author continues in the following vein (paragraph 3) :`` In other words, it connotes and implies that our ancient Indian Vedic lore should be all-round complete and perfect and able to throw the fullest necessary light on all matters which any aspiring seeker after knowledge can possibly seek to be enlightened on.'

In paragraph 9 the reader learns that ``we were agreeably astonished and intensely gratified to find that exceedingly tough mathematical problems (which the mathematically most advanced present day Western scientific world had spent huge lots of time , energy and money on and which even now it solves with the utmost difficulty ...) can be easily and readily solved with the help of these ultra-easy Vedic Sutras ...contained in the Parisista (the Appendix-portion) of the Atharvaveda in a few simple steps and by methods which can be conscientiously described as mere mental arithmetic."

Having informed us that he has regularly lectured on the subject at Nagpur University (paragraph 11), the author unfolds his `revolutionary' findings in paragraph 14 (vi): ``As regards the time required by the students for mastering the whole course of Vedic mathematics as applied to all its branches, we need merely state from our actual experience that 8 months (or 12 months) at an average rate of 2 or 3 hours per day should suffice for completing the whole course of mathematical studies on these Vedic lines instead of 15 or 20 years required according to the existing systems of the Indian and also of foreign universities."

After all this introduction, we find inside the book mathematics of the middle and high school level, where the emphasis is throughout on a series of tricks (whose origins are explained) to solve various problems: for example, faster ways of dividing, multiplying and factorising numbers, and ways of dealing with problems in conics . Some readers may find the book diverting; some of the methods described may be actually be useful somewhere in school teaching (though this needs detailed investigation). The real issue, however, is not so much the level of the contents as the additional philosophical baggage that is provided. How are we to take the assertion that the Vedas provide the answers to all questions of mathematics? Is there any scientific sense in which a particular body of knowledge can be said to contain the answer to all questions of mathematics? The contents of the book seem far-removed from this goal; comprising as they do elementary mathematics; even the list provided of the subjects intended to be dealt with by the author in later volumes (which were never published) does not rise above this level.

In fact, mathematics from the high school level indisputably requires material that cannot be provided by the `Vedic' or for that matter `Islamic', `Greek', or `Babylonian'. Modern mathematical teaching requires considerable input that cannot be traced back to antiquity. The book ``Vedic Mathematics," seeks constantly to prove the superiority of various methods to those used in the ``Western" methods, the reference point often being English texts long fallen out of use, presumably dating to the author's youth. Nor is the book of any use in studying the history of mathematics in India; it is simply unequal to the task.

What, in fact, is ``Vedic" about the mathematics set out in the book? Some of the examples cited are already well known to historians and adequately described elsewhere. As for the appendices to the Atharvaveda, the alleged source of the Vedic mathematical riches described in the book, they appear to be totally non-existent. No authoritative edition of the text of the Atharvaveda contains the appendices referred to. The game is given away in the General Editor's Foreword, where it is noted that these ``appendices'' are not part of the established texts but should be regarded as new and the `discovery' of the author himself! The General Editor also notes that the style of language makes it clear that the `appendices' are the author's own discovery and that the book should be judged on its own merits - where of course the book fails miserably from the standpoint of science.

Despite its absurd claims and transparently bogus status, Jagadguru Swami's book became the focus of a National Workshop on Vedic Mathematics held at Jaipur in March 1988 by the Rashtriya Veda Vidya Pratishthan and various other Government bodies and universities. The proceedings were published as ``Issues in Vedic Mathematics'' (Khare, 1991).

The seminar enjoyed the official patronage of the Ministry of Human Resource Development and the objectives of the seminar were spelt out in a letter to all participants by the Special Secretary, Department of Education. The papers presented at the seminar scarcely rise above the level of the book that inspired them. There is much talk of applying the ``Vedic'' methods to developing algorithms for computers (some participants opt out and claim that these methods render calculators and computers redundant) and some of the articles indeed are, to put it charitably, nonsense from any scientific viewpoint.

The seminar ends with recommendations to the Government: a second seminar to be held on VM, in which traditional and modern mathematicians are to study the introduction of VM at different levels; a committee to study the introduction of VM in schools; research in VM; multimedia strategies for awareness of VM; the Department of Electronics to be sounded out on VM applications to computer technology.

One interesting whistle-blowing paper (Shukla, 1991, page 31) brings to light the fact that the Shankaracharya's book is not based on what is in the Vedas.

Clearly the BJP-led Governments rushed in where others feared to tread and introduced this material in the schools. Any doubts about their reasons for doing so were dispelled by the BJP Education Minister of Uttar Pradesh at a workshop in Allahabad in April 1992, he simply declared that ``whatever is very ancient for India, that precisely is most modern for the world" (see Seminarist, 1992). The efforts of Hindutva in respect of the exact sciences would indeed be laughable were it not for the potential for serious damage at the school level.

Textbooks and the 'Aryan' Thesis

Further evidence of the Hindutva attitude to the pursuit of truth and scientific rigour is available in the history textbooks foisted on students in the four erstwhile BJP-ruled States. Take the case of the compulsory textbook for first-year graduate students titled ``Bharat ki Sanskritik Virasat" introduced in Madhya Pradesh. Essentially a primer of the Hindutva brand of culture, it determinedly pushes the pseudo-thesis that the Aryans did not migrate to the Indian sub-continent from outside but were `indigenous.' This is very much in line with the absolutist assertions made by `Guru' M. S. Golwalkar, the RSS's second supremo and its most important ideologue, in his 1939 work, ``We: or Our Nationhood defined," which the Hindutva camp is doing its best to cover up today. Rejecting theories that held that the `Aryans' migrated to India, Golwalkar asserts: `` Hypothesis is not truth. Out of the heap of hypotheses we reject all and positively maintain that we Hindus came into this land from nowhere, but are indigenous children of the soil always, from times immemorial and are natural masters of the country. Here we compiled our inimitable Vedas, reasoned out our Philosophy of the Absolute--the last word on the subject, built our sciences and arts and crafts..."(Golwalkar, 1939, page 8-9). The equation of `Hindu' and 'Aryan'--`` the Hindu, i.e., Aryan race" (Golwalkar, 1939, page 6) is central to the thesis about national identity as expounded in this chillingly-explicit work.

The anti-scientific character of this thesis has been exposed by India's leading historians, among them Dr. Romila Thapar (an excellent article is available in Seminar; see Thapar, 1992). Historians point out that term Aryan should be applied, scientifically speaking, only to a language. The language of the Rig Veda for instance is Old Indo-Aryan. The links between this language and Old Avestan indicates a movement from West Asia to India by Aryan speakers. The evidence ``does not support the notion that India was the homeland of the Aryan-speaking people" (Thapar, 1992, p. 22). Further, Vedic Sanskrit and its dialect variations provide evidence of further geographical movement from the north-west into the Ganga valley. The Aryan speakers did not maintain any racial purity, so what really spread was not a body of racially ``pure" Aryans, but rather the use of the language Old Indo-Aryan. Dr. Romila Thapar goes on to discuss the implications of such pseudo-theses for developing a justification of upper caste domination. There are other dimensions to the pushing of this pseudo-thesis, especially the linking up with the fascistic vision of Golwalkar on national identity and the place of minorities, above all Muslims. Revealingly, Golwalkar was attracted to Nazi Germany's handling of the `minorities' problem: ``To keep up the purity of the Race and it culture, Germany shocked the world by her purging the country of the semitic Races-the Jews. Race pride at its highest has been manifested here. Germany has also shown how well-nigh impossible it is for Races and cultures, having differences going to the root, to be assimilated into one united whole, a good lesson for us in Hindustan to learn and profit by." (Golwalkar, 1939, p.35).

The Challenge before Indian Science

These are matters that should cause serious concern within the scientific community in India. But do they? The latest outrage, an award for astrology at the annual Indian Science Congress and its official defence by no less than a member of the Planning Commission, should be cause enough for serious concern. And, in fact, the award has been given to the president of an occult foundation. Professional scientists have protested but they have not been able to block the move. It is hard to imagine a major conclave of scientists in a developed country not breaking into pandemonium over such an affront to science and scientists, but this is India under the shadow of Hindutva. In fact, seen against the specific background of Ayodhya, the incident assumes even more menacing overtones. Even more shocking is the case of a physicist at the Indian Institute of Technology, Kanpur, who went to Ayodhya as a kar sevak in December 1992 and returned, with a piece of the rubble, to resume his duties in the service of science at one of India's leading S&T institutions.

We have referred in this essay to the many weaknesses of the science and technology infrastructure in India. These weaknesses are intimately connected with the overall social and economic crisis of Indian society today. If, as is widely recognised, the current Hindu fundamentalist wave is a far-Right reactionary response to the crisis, science and technology can hardly expect to remain immune to the influence of fundamentalism. Our scientific and technological institutions are not strong enough to withstand a sustained onslaught which is politically powered; it takes but a few years to dismantle active centres of research and teaching. And in the long run, give or take a few years, there could be a systematic dismantling of science and technology in this country. The direct links that Hindutva pseudo-science has with the less publicised fascist face of the Sangh parivar, suggest that if Hindutva triumphs, science and technology will be made subservient to its original dream of a pseudo-Hindu fascist state (as elaborated by Golwalkar in 1939). If these words seem unduly alarmist, we need to remember that the current grim political situation, if it had been forecast or projected in the mid-1980s, would have been dismissed as unimaginable in India.

What does a serious and genuine commitment to science and technology mean in the current context? In a perceptive essay Jacob Bronowski (Bronowski, 1977) argues that science is not a value-neutral human activity. ``The activity of science is directed to seek the truth (about the material world), and it is judged by the criterion of being true to facts. We can practice science only if we value the truth" (Bronowski, 1977, p.212). Without truth, science is not possible. This truth is not immutable for we find descriptions of nature only up to a certain coarseness, a certain tolerance. This, in turn, implies that science values dissent, for without dissent there would be no challenge of the established concepts and no progress. And the right to dissent needs to be safeguarded. Science values independence of thought because it is a necessary condition of dissent, and originality because it is the tool with which the new is discovered. These values are essential to modern science and science needs a society that recognises these as social values. The right of free and critical enquiry which is implied by these values is one of the abiding things that science has given to society.

We have referred in this essay to the importance of the critical and rational spirit in society for science to flourish. It bears emphasis that it is in assisting in the task of expanding the realm of operation of free and critical enquiry in society that science and scientists fulfil their social responsibility. It is this perception, affirmed and grasped at the mass level, that has led to the remarkable phenomenon of popular science movements in India which seek to empower the people through the transmission of the knowledge of science and the scientific method. Hindutva, and the obscurantism, science fraud and pseudo-science it inflicts on society at the political and, therefore, the mass level, work precisely in the opposite way. From the standpoint of science and its values, Hindutva must be judged to be a serious threat indeed.

A commitment to science is a positive commitment to secularism. The historian K. N. Panikkar has referred (see Panikkar, 1991) to the necessity of expanding the secular space in society, of seizing the initiative from communalism and promoting a positive campaign for secularism. Science belongs firmly to this secular space; if it does not, we cannot conceive of another pursuit, another activity, which does. Hindutva cannot easily challenge the popular perception of the need for science and technology as an integral part of development. This perception can be used to promote a powerful campaign that links secularism firmly with science, that demonstrates that science is impossible without the development of a critical spirit. In the ultimate analysis, the development of science and of the spirit of free and critical enquiry can make a major contribution to eradicating the blight of communalism that is upon India.

Vedic—Mathematics

Mathematics is the queen of subjects. Rightly so, then, Vedic Mathematics is the glowing crown that adorns its proud forehead. Very few of the masses today are aware today, of Vedic mathematics, the magnanimity of its profound implications, and of its origins which guided the rest of the world towards purer and more intricate branches of mathematics and which, laid the foundations for number theory and arithmetic, the teeny-weeny part of which we are taught during our alma-mater days with hardly any reference made to its rightful owners ? our very own ancestors ?who pursued the study of mathematics with no less finesse than that of a fine art.

A well-known fact it is, as every one knows now, for he/she has seen himself/herself or his friend, being answered by his teacher, during the primary years of his education, in response to his/her query full of childish criticism "What has India given to Mathematics? that the numeral 0 was indeed the creation of Indian mathematicians. Introduction of zero brought about a new revolution into the world of mathematics. It was zero that gave rise to the idea of representing numbers using base 10, as it is commonly used today. And it is zero because of which you are able to read this article. But why? How would a computer work without zeros and ones!!! So that's the zero there, right!

Though the Arabs are given the credit of taking mathematics into broader frontiers, they had begun their work with the help of Indian manuscripts. The story goes something like this. It was in 773 that the Arabs were able to set their eyes on the astounding developments of numerical methods Indians used when one of the Indian palmist and fortune-teller happened to visit the Arabian lands. So impressed were the Arab mathematicians with Indian inventions that the Arab mathematician Muhammed-Ibna-Musa-Abu-Jafar-Al-Khwarizmi himself came to India to study Indian mathematics. After stating here for some time after learning the subjects to his satisfaction, he wrote his manuscript "Algebra '-b-e-Mukabla' This is how 'Algebra' was born. His works, which were nothing but a translation of his Indian studies, left the European mathematicians spell-bound, especially by the use of base 10 to represent numbers. The idea of representing numbers by base 10, is thus, originally Indian.

The trend then caught on. From Arabs to Greeks, from Greece to Spain and from Spain to Europe. Europeans however, initially reluctant to use base 10 to represent numbers, inevitably began to use it in 1202 (during the time of Bhaskaracharya). Though the mathematical works went on improving as it changed hands, the world availed the first systematically documented use of base 10 only in Bhaskaracharya's manuscript "Lilavati" 4th century mathematician Diaphantus, who is also known as 'Father of Arithmetic' has his works in his book 'Arithmetica' coinciding closely with the Indian manuscripts of earlier age. These are but a few evidences that arithmetic and basic mathematics that has evolved today in various forms, is but the creation of those great olden Indian minds.

In this article, we take a glimpse of the very fantastic inventions of Vedic mathematics in the field of number theory and arithmetic. Though cited here are examples of the methods described in Vedas , Vedic mathematics has its frontiers expanding into many more diverse areas and concepts like astrology, astronomy, geometry, trigonometry, to name a few. The examples

cited here would be useful in performing calculations that you may be coming across everyday. This article would be of course, a welcome change to those who complain that they hardly get time to stretch their legs during those interminably tightly timed aptitude tests! I will like to share some experts of a Book called "Drutganit" (Speed mathematics) by Mr. Shyam Marathe.... The book is in Marathi discussing the techniques of doing mathematical operation of big numbers very quickly using the techniques present in "Vedas" ....

EXAMPLES:

We shall start with a method to multiply 2 numbers. It will reveal to you how innovative Vedic mathematics can be.

Lets deal, to begin with, with numbers that are close to POWERS of 10 i.e. numbers near to 10, 100, 1000, etc.

EXAMPLE 1:

Say, we have to multiply 98 and 97.

(First, try using conventional method and find out how much time it takes!)

Now we go for the Vedic method.

Write down the numbers in this manner:

98 -2

97 -3

In the above representation, -2 and -3 stand for the difference of 98 and 97 from 100. We may call these differences -2 and -3 as OFFSETS of 98 and 97 from 100. We may call 100 as the 'BASE' as differences are taken from 100.

Step 1: First, we multiply the offsets -2 and -3

We get 6. Since our base is 100, which has 2 zeros, the product of offsets must also have 2 digits. Hence we write 6 as 06 and write it down as last 2 digits of our answer.

98 -2
97 -3

06

Step 2: Now for the previous digits, just add any 2 numbers in the above figure crosswise i.e. either (98-3) or (97-2)

We get 95. This is written before 06 as follows: -

98 -2
97 -3

95 / 06

That gives us 9506. That's our answer.

Hence 98 × 97 = 9506

Aint it simple!!

EXAMPLE 2:

Once again, we solve 25 × 98.

25 -75
98 -2

Here, once again, our base is 100. -75 and -2 are offsets of 25 and 98 from 100.

Step 1: -75 × -2 gives 150

Since our base (100) has 2 zeros, the product of offsets must have 2 digits. Hence we write down last 2 digits of 150 i.e. 50 as last 2 digits of our answer. 1 would be treated as carry.

25 -75

98 -2

---

50 (1 carry)

Step 2: Add the numbers crosswise. i.e. (25-2) or (98 - 75).

We get 23.

Add the carry from previous step.

We get 23 + 1 = 24

These are written as first 2 digits of our answer.

25 -75

98 -2

(23+1) / 50

i.e.

25 -75

98 -2

---

24 / 50

Answer: 25 x 98 = 2450

EXAMPLE 3:

Now, lets try for 108 x 109

Let us write down the numbers as:

108 8
109 9

---

and carry out the same method as above.

Note that 8 and 9 are offsets of 108 and 109 from base 100.

Step 1: Product of offsets 8 x 9 = 72

Write down 72 as last digits of our answer.

108 8
109 9

72

Step 2: Add any 2 numbers cross wise (108 + 9) or (109 + 8)

We get 108 + 9 = 117

These are the front digits of the answer.

108 8
109 9

---

117 / 72

Hence 108 x 109 = 11772

EXAMPLE 4:

Lets try 98 × 104.

98 -2
104 4

Step 1: Product of offsets -2 × 4 = -8

We write it down as,

98 -2
104 4

-8

Step 2: Now, 98 + 4 or 104 -2 gives 102.

These are the earlier digits of our answer.

98 -2

104 4

---

102 / -8

Step 3: Since the number after "/ " is as negative number we have to decrease the number to the left of "/" by 1 (i.e. 102 becomes 101). Next, the number 8 (which has a negative sign) has to be deducted from the number base times 1 i.e. deduct 8 from 100 × 1.

i.e. 100 - 8 = 92

92 is written in the place of -8. That makes our result as:

98 -2

104 4

---

101 / 92

Hence 104 × 98 = 10192.

Lets see how it simplifies our calculation for huge numbers:

EXAMPLE 5:

Multiply 888 by 998:

888 -112

998 -002

---

886 / 224

Here, the base is 1000 i.e. offsets are differences from 1000

-112 × - 002 = 224 (Simple enough)

And 888 - 002 = 886

Hence, 888 × 998 = 886224.

EXAMPLE 6:

Multiply 9997 by 9998:-

9997 -3 (base 10,000)
9998 -2

9997 - 2) /0006

(Here, base is 10,000, which has 4 zeros. Hence the product of offsets

-2 and -3 is padded with zeros to make it a 4-digit number)

Hence,

9997 -3
9998 -2

9995 / 0006 = 99950006 (Answer!!!)

EXAMPLE 7:

Multiply 999979 by 999998:

999979 -21 (base 1,00,000)

999998 -2

(999979 - 2) / 000042

Here, -21 × -2 = 42.

Base has 6 zeros. Hence pad 42 with 4 zeros to make 000042.

Then, 999979 - 2 = 999977. Those are the earlier digits of our answer.

999979 -21
999998 -2

999977 / 000042

Hence, 999979 × 999998 = 999977000042.

Ever wondered multiplying such big numbers could be that simple!!!

The methods discussed above are extremely effective for multiplying numbers near the powers of 10. Similar methods can be applied to find the product of ANY 2 numbers (irrespective of whether they are near powers of 10) using ANY MULTIPLE of 10 as base.

It is being taught in some of the most prestigious institutions in England and Europe. NASA scientists applied its principles in the area of artificial intelligence. And yet, in the country of its birth it languishes as a forgotten science.

Vedic mathematics, which simplifies arithmetic and algebraic operations, has increasingly found acceptance the world over. Experts suggest that it could be a handy tool for those who need to solve mathematical problems faster by the day, especially in a system where the emphasis is on examinations.

The subject was revived largely due to the efforts of Jagadguru Swami Bharathikrishna Tirthaji of Puri Jaganath. Having researched the subject for years, even his efforts would have gone in vain but for the enterprise of some disciples who took down notes during his last days. That resulted in the book, Vedic Mathematics, in the 1960s.

Says P.R. Srinivas, who has taught the subject in some of the city's colleges: ``It is an ancient technique which simplifies multiplication, divisibility, complex numbers, squaring, cubing, square and cube roots. Even recurring decimals and auxiliary fractions can be handled by Vedic mathematics."

Vedic scholars did not use figures for big numbers in their numerical notation. Instead, they preferred to use the Sanskrit alphabets, with each alphabet constituting a number. Several mantras, in fact, denote numbers; that includes the famed Gayatri mantra which adds to 108 when decoded. The bases of Vedic mathematics are the 16 sutras which attribute a set of qualities to a number or a group of numbers. Mr Srinivas feels that given the initial training in modern maths in today's schools, students will be able to comprehend the logic of Vedic mathematics only after they have reached the 8th standard. Among his students are Armymen and doctors in their 50s and younger students keen to make their mark in competitive entrance exams.

India's past could well help them make it in today's world.

Vedic Maths, a Forgotten Science *

Some of the Sutras (Phrases) used in Vedic Mathematics:*

1st Example - 1 Divided by 19, 29, 39, ... 129 etc. *

2nd Example - Square of Numbers ending in 5 *

3rd Example - Multiplier-digits consist entirely of nines*

4th Example General Multiplication of any number by any number *

5th Example Algebraic Divisions *

6th Example Division *

7th Example Factorisations of Quadratics *

8th Example - Verifying Correctness of answers *

9th Example Factorisations of Harder Quadratics *

10th Example - Factorisations of Harder Quadratics - Special Cases *

Sixteen Simple Mathematical Sutras (Phrases) From The Vedas *

Notes and Quiz *

7

Application of Vedic Mathematics in Integrals

The Differential

Earlier in the differentiation chapter, we wrote $\frac{dy}{dx}$ and $f'(x)$ to mean the same thing. We used $\frac{d}{dx}$ as an operator.

We now see a different way to write, and to think about, the derivative.

Definition: The differential of $y = f(x)$ is written:

$$dy = f'(x)dx.$$

Mini-Lecture

Note: We are now treating $\frac{dy}{dx}$ as a fraction.

EXAMPLE:

Find the differential of $y = 3 \times 5 - x$.

ANSWER

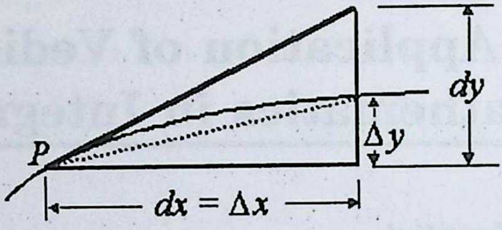
$$dy = f'(x)dx$$

$$dy = (15x^4 - 1)dx$$

Note: We could use the differential to estimate the real change in value of a function (Δy) caused by a small change in x (written as Δx). Many text books do this, but it is pretty silly, since we can easily find the exact change - why approximate it?

We are introducing differentials here as an introduction to the notation used in integration.

How are dy, dx and Δy and Δx related?



Relative Error

Note: We may perform a calculation and find an error of 1 cm. If this is part of a problem involving lengths of 8 cm, then we have a big problem. If it involves lengths of 3 km, we have an insignificant problem. We usually talk about the relative error:

$$\frac{1\,\text{cm}}{8\,\text{cm}} = 12.5\% \text{ or } \frac{1\text{ cm}}{3\text{ km}} = 3.3\times10^{-4}\%$$

rather than the absolute error of 1 cm.

Proportionate and Percentage Change

The proportionate change in y(x) is given by $\frac{dy}{y}$ (no units).

The percentage change in y(x) is given by $\frac{dy}{y}\times100\%$

Antiderivatives and the Indefinite Integral

We wish to perform the opposite process to differentiation. This is called "antidifferentiation" and later, we will call it "integration".

EXAMPLE

If we know that

$$\frac{dy}{dx} = 3x^2$$

and we need to know the function this derivative came from, then we "undo" the differentiation process. (Think: "What would I have to differentiate to get this result?")

$y = x^3$ is ONE antiderivative of $\frac{dy}{dx} = 3x^2$

There are infinitely many other antiderivatives which would also work:

$$y = x^3 + 4$$

$$y = x^3 + \pi$$

$$y = x^3 + 27.3$$

In General: $y = x^3 + K$, is the indefinite integral. K is called the constant of integration.

In electrical engineering, we prefer to write "+K", since C (as used in most math texts) is used for capacitance.

We write:

$\int 3x^2 dx = x^3 + K$ and say:

"The integral of $3x^2$ with respect to x equals $x^3 + K$."

Here is a template you can play with to get the idea.

The $\int$ sign is an elongated "S", standing for "sum". Later we will see that the integral is the sum of the areas of infinitely thin rectangles.

SUM: $\int$ "integration is an infinite sum"

Note: Sometimes we write: F(x) to mean the integral of f(x). So we have:

EXERCISE:

Find $\int(x^2-5)dx$

ANSWER

$$\int(x^2-5)dx=\frac{x^3}{3}-5x+K$$

Note: In general, we can use:

1. $\int kdx = kx + K$ (k,K are constants.)

The integral of a constant is that constant times x.

EXAMPLE:

$$\int 4dx = 4x + K$$

2. $\int x^n dx = \frac{x^{n+1}}{n+1} + K \ (n \neq -1)$

For the integral of a power of x: add 1 to the power and divide by the new number.

EXAMPLE:

$$\int x^5 dx = \frac{x^{5+1}}{5+1} + K$$

$$= \frac{x^6}{6} K$$

DON'T FORGET THE "+ K" (or "+ C"). THIS CONSTANT OF INTEGRATION IS VITAL IN LATER APPLICATIONS.

EXAMPLE 1:

$\int 7x^6 dx$

ANSWER

$$\int 7x^6 dx = 7\frac{x^7}{7} + K = x^7 + K$$

EXAMPLE 2:

$$\int\left(3x^2+\sqrt{x}-\frac{5}{x^3}\right)$$

ANSWER

$$\int\left(3x^2+\sqrt{x}-\frac{5}{x^3}\right) = \int\left(3x^2+x^{1/2}-5x^{-3}\right)dx$$

$$=x^3+\frac{x^{3/2}}{\frac{3}{2}}-5\frac{x^{-2}}{-2}+K$$

$$=x^3+\frac{x^{3/2}}{3}-\frac{5x^{-2}}{2}+K$$

EXAMPLE 3:

$$\int\sqrt[3]{x^2}\,dx$$

ANSWER

$$\int\sqrt[3]{x^2}\,dx = \int x^{2/3}dx$$

$$=\frac{x^{\frac{2}{3}+1}}{\frac{2}{3}+1}+K=\frac{x^{\frac{5}{3}}}{\frac{5}{3}}+K$$

$$=\frac{3\sqrt[3]{x^5}}{5}+K$$

EXAMPLE 4:

A particular curve has $\frac{dy}{dx}=3x^2-2x$.

We are told that the curve passes through the point (2, 5). Find the equation of the curve.

EXAMPLE 5:

This is different to the other exercises above! It is a function of a function situation, so we have to do the reverse of the chain rule, which we met in the section on differentiation.

The new rule we require is...

Power Formula for Integration

$$\int u^n du = \frac{u^{n+1}}{n+1} + K \left(n \neq -1\right)$$

This requires a substitution step, where u(x) is some function of x.

Now back to the problem to see how to apply this formula:

ANSWER

$$\int \left(2x^4 - 5\right)^6 x^3 dx$$

We use, as a starting point, the substitution

$$u = 2x^4 - 5.$$

Now $du = 8x^3\ dx$

Our question has only x^3dx so we need to divide both sides by 8:

$$\frac{1}{8}du = x^3dx$$

We can now rewrite our question as:

$$\int \left(2x^4 - 5\right)^6 x^3 dx = \frac{1}{8}\int u^6 du$$

$$= \frac{1}{8} \times \frac{u^7}{7} + K$$

$$= \frac{u^7}{56} + K \quad = \frac{\left(2x^4 - 5\right)^7}{56} + K$$

EXAMPLE 6:

$$\int (x^3-2)^6 (3x^2)dx$$

ANSWER

We use, as a starting point, $u = x^3 - 2$.

Now $du = 3x^2dx$

This time, this is exactly what we have in the question, so there is no need to divide both sides.

We can now write:

$$\int (x^3-2)^6 (3x^2)dx = \int u^6 du$$

$$= \frac{u^7}{7} + K = \frac{(x^3-2)^7}{7} + K$$

EXAMPLE 7:

Find $\int \frac{x}{\sqrt{x^2+9}}dx$ using a substitution.

ANSWER

Put $u = x^2 + 9$

Then $du = 2xdx$

The question has xdx so we write

$$\frac{du}{2} + xdx$$

Now

$$\int \frac{x}{\sqrt{x^2+9}}dx = \frac{1}{2}\int \frac{du}{\sqrt{u}}$$

$$= \frac{1}{2}\int u^{-1/2}du$$

$$= \frac{1}{2}\frac{u^{1/2}}{1/2} + K = \sqrt{x^2+9} + K$$

EXAMPLE 8:

Given $y' = \sqrt{2x+1}$, find the function $y = f(x)$ which passes through the point (0,2).

ANSWER

Note: y' means the derivative of y, that is dy/dx.

$$y' = \sqrt{2x+1}$$

So

$$y = \int \sqrt{2x+1}\, dx$$

This question requires us to integrate, and in the process, to find the constant of integration.

Put $u = 2x + 1.$

Now $du = 2dx$

So

$$\frac{1}{2}du = dx$$

So

$$y = \int \sqrt{2x+1}\, dx$$

$$= \frac{1}{2}\int u^{1/2}du$$

$$= \frac{1}{2} \times \frac{2}{3} \times u^{3/2} + K$$

$$= \frac{1}{3}(2x+1)^{3/2} + K$$

Now if x = 0 then y = 2 (from the question).

$$2 = \frac{1^{3/2}}{3} + K$$

and this gives K = 5/3.

So

$$y = \frac{(2x+1)^{3/2}}{3} + \frac{5}{3}$$

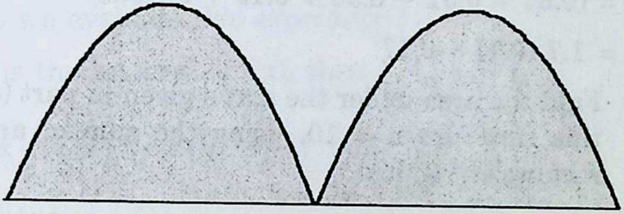
is the required function.

Note: You will see "+K" and "+C" in this work. Most textbooks use + C.

Always use +K if you are answering electrical problems.

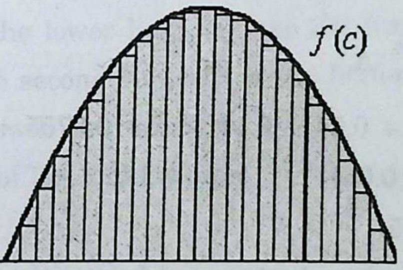
The Area under a Curve

A building has parabolic archways and we need to supply glass to close in the archways. How much glass is needed?



We need to know the area under the curve.

Before integration was developed, they could only approximate the answer by dividing the space into rectangles and adding the areas:



The height of each rectangle is found by calculating the function values, as shown for the typical case x = c. We get a better result if we take more and more rectangles.

EXAMPLE OF APPROXIMATION USING RECTANGLES:

(a) Find the area under the curve $y = 1 - x^2$ between $x = 0.5$ and $x = 1$, for $n = 5$, using the sum of areas of rectangles method.

Now for the normal answer:

ANSWER

Since $n = 5$,

$$h = \Delta x = \frac{b-a}{n} = \frac{1-05}{5} = 01$$

$$A = \sum_{i=1}^{5} A_i$$

$$= (0.64 + 0.51 + 0.36 + 0.19 + 0)\ (0.1)$$

$$= 1.7\ (0.1) = 0.17$$

(b) Find the area under the curve given in part (a), but this time use $n = 10$, using the sum of areas of rectangles method.

ANSWER

Since $n = 10$,

$$h = \Delta x = \frac{1-05}{10} = 0.05$$

$$A = \sum_{i=1}^{5} A_i$$

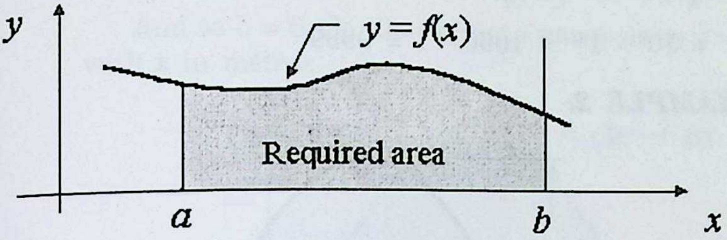
$$= (0.6975 + 0.64 + 0.19 + \ldots + 0.9755 + 0)\ (0.05)$$

$$= 3.7875\ (0.05)$$

$$= 0.189375.$$

There must be a better way! Integration was developed by Newton and Leibniz to save all this "adding areas of rectangles" work.

General Case



[Note: The curve is completely ABOVE the x-axis].

By a Δ-process, we can show that in general, the exact area under a curve y = f(x) from x = a to x = b is given by the definite integral:

$$\text{Area} = \int_a^b f(x)dx$$

How do we evaluate this expression?

If F(x) is the integral of f(x), then

$$\int_a^b f(x)dx = \left[f(x)_a^b \right] = F(b) - F(a)$$

This means:

To evaluate a definite integral, follow these steps:

- integrate the given function (do not include the K)
- substitute the upper limit (b) into the integral
- substitute the lower limit (a) into the integral
- subtract the second value from the first value
- the answer will be a number

This forms part of The Fundamental Theorem of Calculus.

Mini-Lecture

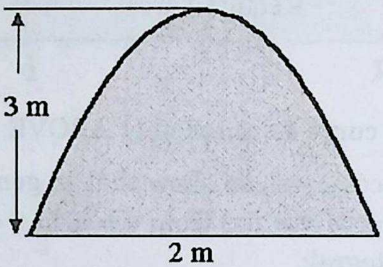
EXAMPLE 1:

Evaluation of Definite Integral:

$$\int_1^{10} 3x^2dx = \left[x^3\right]_1^{10}$$

$$= 10^3 - 1^3 \ = 1000 - 1 = 9999$$

EXAMPLE 2:



If the arch is 2 m wide at the bottom and is 3 m high,

(i) find the equation of the parabola

(ii) find the area under each arch using integration.

ANSWER

(i) We place the parabola so that the left side of the arch passes through (0, 0) and the right side will pass through (2, 0), since the arch is 2 m wide at the bottom. The vertex of the arch is at (1, 3).

General form of a parabola:

$$y = ax^2 + bx + c$$

At $x = 0$, $y = 0$ and on substituting,

we get $0 = 0 + 0 + c$. So $c = 0$.

At $x = 1$, $y = 3$ and on substituting,

we get $3 = a + b$.

At $x = 2$, $y = 0$ and on substituting,

we get $0 = 4a + 2b$.

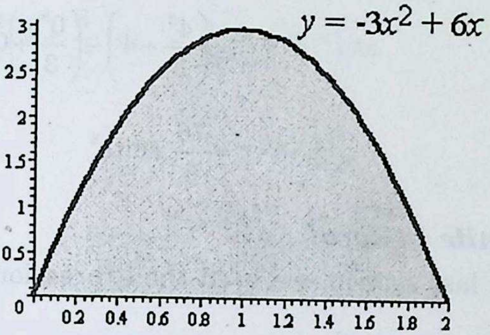
This gives the simultaneous equations

$$a + b = 3$$

$$2a + b = 0$$

Subtracting the 1st line from the 2nd gives a = -3.

And so b = 6. So the required parabola is $y = -3x^2 + 6x$, with x in metres.



The process of finding the equation is called modelling. It is a very important skill in science and engineering.

(ii) Now for the area:

$$\int_0^2 \left(-3x^2 + 6x\right)dx = \left[-x^3 + 3x^2\right]_0^2$$

$$= [-(2^3) + 3(2)^2] - [0 + 0]$$

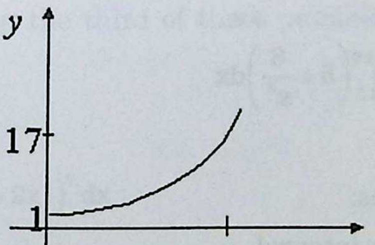
$$= [-8 + 12] = 4m^2.$$

EXAMPLE 3:

Find the (exact) area under the curve $y = x^2 + 1$ between x = 0 and x = 4 and the x-axis.

Now for the conventional answer:

ANSWER



The area is given by:

$$\int_0^4 (x^2+1)dx = \left[\frac{x^3}{3}+x\right]_0^4$$

$$= \left(\frac{4^3}{3}+4\right) - \left(\frac{0^3}{3}+0\right)$$

$$= \frac{76}{3} \text{ units}^3$$

The Definite Integral

In the last section, we used the expression

$$\int_a^b f(x)dx = [F(x)]_a^b = F(b) - F(a)$$

to find the area under a curve. This expression is called a definite integral. It does not involve the constant of integration and it gives us a definite value (a number) at the end of the calculation.

CARE:The integral only gives us an area when the whole of the curve is above the x-axis in the region from $x = a$ to $x = b$. If this is not the case, we have to break it up into individual sections.

It is quite possible to have a definite integral having value 0 or negative. There are many more applications of the integral than areas under curves.

EXAMPLE:

Evaluate:

$$\int_{1.2}^{1.6} \left(5+\frac{6}{x^4}\right)dx$$

SOLUTION:

This requires:

(1) Find the integral

(2) Substitute 1.6 into the integral

(3) Substitute 1.2 into the integral

(4) Subtract.

$$\int_{1.2}^{1.6}\left(5+\frac{6}{x^4}\right)dx = \int_{1.2}^{1.6}\left(5+6x^{-4}\right)dx$$

$$= \left[5x-2x^{-3}\right]_{1.2}^{1.6}$$

$$= 7.5117 - 4.8426$$

$$= 2.6691$$

Recall

Recall the substitution formula for integration:

$$\int u^n du = \frac{u^{n+1}}{n+1}+K \qquad (n \neq -1)$$

Definite Integrals and Substitution

When we substitute, we are changing the variable, so we cannot use the same upper and lower limits. We can either:

- Do the problem as an indefinite integral first, then use upper and lower limits later
- Do the problem throughout using the new variable and the new upper and lower limits
- Show the correct variable for the upper and lower limit during the substitution phase.

We will be using the third of these possibilities.

EXAMPLE:

Find:

$$\int_{-1}^{0} x^3\left(1-2x^4\right)^3 dx$$

using a substitution.

ANSWER

Put $u = 1 - 2x4$

Then $du = -8x^3dx$

The question has x^3dx so we write

$$-\frac{du}{8} = x^3dx$$

So we have:

$$\int_{-1}^{0} x^3\left(1-2x^4\right)^3 dx = -\frac{1}{8}\int_{x=-1}^{x=0} u^3du$$

$$= -\frac{1}{8}\times\left[\frac{u^4}{4}\right]_{x=-1}^{x=0}$$

$$= -\frac{1}{32}\left[u^4\right]_{x=-1}^{x=0}$$

$$= -\frac{1}{32}\left[\left(1-2x^4\right)^4\right]_{-1}^{0}$$

$$= -\frac{1}{32}\left[(1-0)^4-(1-2)^4\right]$$

$$= -\frac{1}{32}\left[(1)-(1)\right]$$

$= 0.$

Note: If we take the second approach, *i.e.,* leaving the variable changed, we have:

$u = 1 - 2x^4.$

As $x = -1 \to 0,$

then $u = -1 \to 1$

So the problem becomes:

$$\int_{-1}^{0} x^3\left(1-2x^4\right)^3 dx = -\frac{1}{8}\int_{-1}^{1} u^3 du$$

$$= -\frac{1}{32}\left[u^4\right]_{-1}^{1}$$

$$= -\frac{1}{32}\left[1^4-(-1)^4\right] = 0$$

This second approach is quite useful later when the substitutions become more involved (e.g. trigonometric substitution).

EXERCISES

In physics, work is done when a force acting upon an object causes a displacement. (For example, riding a bicycle...).

If the force is not constant, we must use integration to find the work done.

We use:

$$W = \int_a^b F(x)dx$$

where F(x) is the variable force.

QUESTION 1:

Find the work done if the force is $F(x)=\sqrt{2x-1}$ and it is acting from x = 1 to x = 5.

That is, evaluate:

$$\int_1^5 \sqrt{2x-1}dx$$

ANSWER

Put u = 2x - 1 then du = 2 dx

So $$\frac{du}{2} = dx$$

So we have:

$$\int_1^5 \sqrt{2x-1}\,dx = \frac{1}{2}\int_{x=1}^{x=5} u^{1/2}du$$

$$= \frac{1}{2} \times \left[\frac{2}{3}u^{3/2}\right]_{x=1}^{x=5}$$

$$= \frac{1}{3}\left[(2x-1)^{3/2}\right]_1^5$$

$$= \frac{1}{3}\left[9^{3/2} - 1^{3/2}\right]$$

$$= \frac{1}{3}[27-1]$$

$$= \frac{26}{3}$$

So the work done is 8.67 units.

Application: The average value of a function f(x) from a to b is given by:

$$\text{Average} = \frac{\int_a^b f(x)dx}{b-a}$$

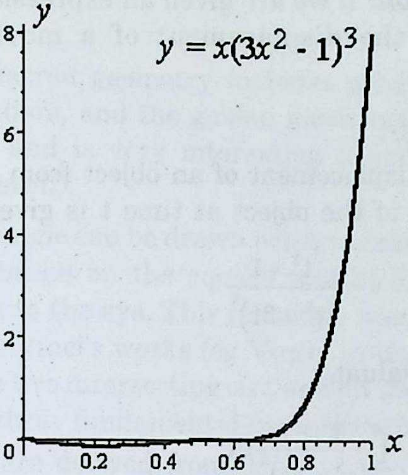
QUESTION 2:

Find the average value of $x(3x^2 - 1)^3$ from 0 to 1.

Here is the graph of the situation:

In this case, b - a = 1, so we simply need to evaluate:

$$\int_0^1 3\left(2x^2-1\right)^3 dx$$



ANSWER

Put $u = 3x^2 - 1$, then $du = 6x\,dx$

So $$\frac{du}{6} = x\,dx$$

$$\int_0^1 x\left(3x^2-1\right)^3 dx = \frac{1}{6}\int_{x=0}^{x=1} u^3 du$$

$$= \frac{1}{6}\left[\frac{u^4}{4}\right]_{x=0}^{x=1}$$

$$= \frac{1}{24}\left[\left(3x^2-1\right)^4\right]_0^1$$

$$= \frac{1}{24}\left[\left(3(1)^2-1\right)^4 - \left(3(0)^2-1\right)^4\right]$$

$$= \frac{1}{24}[16-1]$$

$$= \frac{15}{24} = \frac{5}{8}.$$

So the average value required is 0.625 units.

Application: If we are given an expression for velocity, we can find the displacement of a moving object by integration:

QUESTION 3:

Find the displacement of an object from t = 2 to t = 3, if the velocity of the object at time t is given by:

$$\nu = \frac{t^2+1}{\left(t^3+3t\right)^2}$$

That is, evaluate:

$$\int_2^3 \frac{t^2+1}{\left(t^3+3t\right)^2}dt$$

ANSWER

Put $u = t^3 + 3t$, then $du = (3t^2 + 3)\,dt = 3(t^2 + 1)\,dt$

So $$\frac{du}{3} = \left(t^2+1\right)dt$$

So we have:

$$\int_2^3 \frac{t^2+1}{\left(t^3+3t\right)^2}dt = \frac{1}{3}\int_{t=2}^{t=3}\frac{1}{u^2}du$$

$$= \frac{1}{3}\int_{t=2}^{t=3}u^{-2}du$$

$$= \frac{1}{3}\left[\frac{1}{u}\right]_{t=2}^{t=3}$$

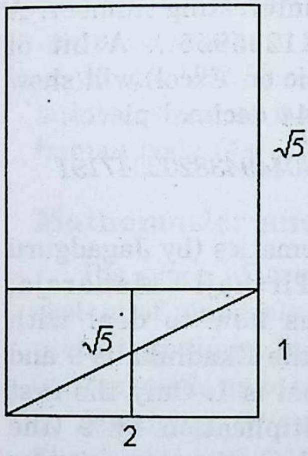
$$= \frac{1}{3}\left[\frac{1}{t^3+3t}\right]_2^3$$

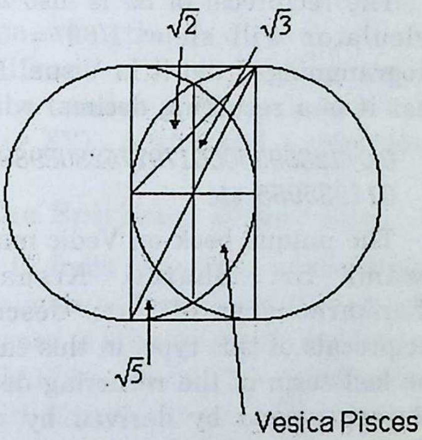
$$= \frac{1}{3}\left[\frac{1}{3^3+3(3)} - \frac{1}{2^3+3(2)}\right]$$

Golden Mean

The science of sacred geometry includes study of the Platonic solids, numbers, and the golden mean ratio.. This is all mathematics, and is very interesting if you are so inclined (left brain stuff).

The Golden Rectangle can be drawn using a straight line and compass. It is based on the square root of 5, and is particularly pleasing to the eye. This rectangle was used in some of Leornado da Vinci's works (eg Virgin in the Cave). Also shown below are two intersecting circles with the Vesica Pisces, and how the three fundamental geometries based on $\sqrt{2}$, $\sqrt{3}$ and $\sqrt{5}$ and are derived from it.





Fibonacci Sequences and the Phi Ratio - The Phi (Φ) ratio turns up frequently in nature. It can be derived from geometry or from a Fibonacci sequence. From geometry it's value is:

$$\Phi = \frac{1+\sqrt{5}}{2} = 1.618033989....$$

From the Fibonacci sequence (each term is derived from adding the previous two terms):

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946, ...

diving two successive terms yield values closer and closer to Φ, eg 10946/6765 = 1.618033999...

Another sequence:

1, 3, 4, 7, 11, 18, 29, 47, 76, 123, 199, 322, 521, 843, 1364, 2207, 3571, 5778, 9349, 15127, ...

yields $\sqrt{5}$ in the limit when a term from the second series is divided by a term from the first, eg the 18th terms 5778/2584 = 2.236068112... (cf 2.236067978...).

Reciprocal of 89

The reciprocal of 89 is also an interesting number. A calculator will show 1/89 = 0.011235955... A bit of programming (I did it in Visual Basic on Excel) will show that it is a recurring decimal with 44 decimal places:

0.01123595505617977528089887640449438202247191 011235955 etc.

The unique book on Vedic mathematics (by Jagadguru Swami Sri Bharati Krsna Tirthaji Maharaja, Shankaracharya of Puri) describes how to deal with reciprocals of this type, in this case the Ekadhika is 9 and the last term of the recurring decimal is 1. Only the first 22 terms need by derived by multiplication by 9 (the Ekadhika) at which point 88 (which is the denominator minus the numerator) is obtained. The rest of the terms are derived by 9's complement, i.e:

9 8 8 7 6 4 0 4 4 9 4 3 8 2 0 2 2 4 7 1 9 1

0 1 1 2 3 5 9 5 5 0 5 6 1 7 9 7 7 5 2 8 0 8

9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9

Starting from the top right, 1 x 9 = 9, which is the 2nd digit. 9 × 9 = 81, put down 1 carry 8. 9 × 1 = 9 + 8 = 17, put down 7 carry 1, etc.

Just thought I'd mention that for fun! The Fibonacci sequence is actually "hidden" inside 1/89, viz:

```
0 1 1 2 3 5 8 3 1 4 5 9 4 3 7 0 7 7 4 1 5 6 1 7 8 . .
            1 2 3 5 8 4 3 7 1 8 9 8 8 6 4 1 5 6 . .
                    1 2 3 6 9 5 5 1 7 9 7 6 3 . .
                            1 2 4 6 0 7 8 6 . .
                                  1 1 2 4 . . .

0 1 1 2 3 5 9 5 5 0 5 6 1 7 9 7 7 5|2 8 0 0 0 3 8 ...
```

On the top line I have started to write the Fibonacci sequence, 1, 1, 2, 3, 5, 8, 13. At 13 I put the 3 on the top line and carry the 1, adding it to the 8. This continues carrying 12 when we get to 123, etc. There are also 1's which get carried when the columns are added together. The | shows the accuracy of 1/89 for the number of terms of the Fibonacci sequence taken- when the numbers are all added up you get 1/89. The significance of the 44 recurring decimals is interesting as it is the number of chromosomes in the human body (44 + XX or XY) - is this just a coincidence?

Mathematics and the Spiritual Dimension

It's place of origin is India (the land of the present system of numerals, decimals and zero) and dates back to prehistoric times. In essence, it is based on sixteen formulas (sutras) made up to barely 120 words in all. It was discovered by Jagadguru Swami Sri Bharati Krsna Tirth Maharaja, Shankaracharya Of Govardhana Math, Puri who propagated his pioneering work through out the world.

It must be emphasized that although because of its origin, it is rightly called Vedic Mathematics, the mathematics it deals with is universal in that it does not require the knowledge of Sanskrit nor any acquaintance with the Vedas. Anyone who is conversant with the basics of mathematics can understand and follow these methods. Let us now see why Vedic Mathematics has become so popular and is rated so high by it's users.

It is very original, totally unconventional and provides a new thinking and approach. Vedic Mathematics is so powerful, yet simple and fun to work with.

It's word-formula lead to efficient and super fast calculations.

It encourages mental calculations since it handles the numbers of small magnitudes.

It is easy, simple, direct and straightforward. The students are freed from committing to memorise the multiplication tables and the like.. They are enthusiastic in learning the methods and eagerly look forward to the mathematics classes. They also enjoy sharing their newfound knowledge with others.

Everyone loves variety and Vedic mathematics offers it in ample measure.

It is comprehensive and is based on pattern recognition.

It is exceedingly flexible and offers a large number of alternatives for almost every kind of problem. It is this aspect that captivates the students and others the most. The weaker students gain mastery of the subject slowly and steadily by taking advantage of the flexibility and availability of alternatives for a given problem; in contrast, present available blanket methods provide only two options: "to learn them or leave them". On the other hand, the bright students take full advantage of the flexibility by learning to be creative and challenge in choosing the most appropriate and time saving method that is consistent with underlying pattern of a given problem.

Finally,all areas of modern mathematics, be it pure or applied, come under the scope of Vedic mathematics. This is because it provides a unified approach to different areas of mathematics by the application of the same work formulas to diverse fields like trigonometry, analytical geometry, calculus,differential equations and so on. The present day researchers in Vedic Mathematics have confirmed the enormous versatility that it has in this respect. The spin off this extendibility is that students who have been trained in the application of Vedic Mathematics to arithmetic can easily move over to college and higher mathematics deriving the same benefits as they did in the case of arithmetic.

" *Like the crest of the peacock,*

Like the gem on the head of a snake,

So is mathematics at the head of all knowledge. "

Mathematics is regarded as science of all sciences. Mathematics stands forth as that which unites and mediates between man and nature, thought and perception, inner and outer world. Vedic mathematics is not just a pedagogic and research tool but an introduction to ancient civilization. It is thus a bridge across centuries, civilizations, linguistic barriers and national frontiers.

Vedic mathematics has originated from that Vedas. VED is all divine knowledge. Any knowledge derived from the Ved is bound to have the touch of the divine bliss. Therefore the very natural, easy and super fast algorithms of Vedic mathematics bring an upsurge of joy and bliss. Due to its very special and universal features, Vedic maths system converts the dry and tedious maths into playful and joyful subject, which everyone learn with smiles. Therefore the Vedic maths is the gift of the Vedas to solve the problem of MATHS ANXIETY being faced in maths education in the world.

Sutras: The Natural Formula

In Sanskrit, the ancient language of India, the word Sutra means "Thread of Knowledge". In English we have the word Suture from Sutra and Suture is the thread used for stitching wounds together. So each rule is a thread of knowledge and the whole subject is based on these sutras.

The system is based on 16 Vedic Sutras together with thirteen sub-sutras which are actually word formulae describing natural ways of solving a whole range of mathematical problems. These are 16 one-line formulae originally written in Sanskrit, which can be easily memorized, enable one to solve long mathematical problems quickly.

The Main Sutras

Ekadikena Purvena(also a corollary)	By one more than the one before.
Nikhilam Navatascaramam Dasatah	All from 9 and the last from 10.
Urdhva-tiryabhyam	Vertically and Cross-Wise
Paravartya Yojayet	Transpose and Apply
Sunyam Samyasamuccaye	The summation if equal to Zero
(Anurupye) Sunyamanyat	If One is in Ratio the Other is Zero
Sankalana - vyavakalanabhyam	By Addition and by Subtraction
Puranapuranabhyam	By the Completion or Non-Completion
Chalana-Kalanabhyam	Sequential Motion
Yavadunam	The Deficiency
Vyastisamastih	Whole as One and One as Whole
Sesanyankena Caramena	The Remainders by the Last Digit
Sopantyadvayamantyam	The Ultimate and Twice the Penultimate
Ekanyunena Purvena	By One Less than the Previous One ·
Gunitasamuccayah	The Whole Product is the same
Gunakasamuccayah	Collectivity of multipliers

The Sub Sutras

Proportionately
The Remainder Remains Constant
The First by the First and the Last by the Last
For 7 the Multiplicand is 143
By Osculation
Lessen by the Deficiency
Whatever the Deficiency lessen by that amount & set up Square of Deficiency
Last Totalling 10
Only the Last Terms
The Sum of the Products
By Alternative Elimination and Retention
By Mere Observation
The Product of the Sum is the Sum of the Products
On the Flag

Vedic Mathematics as Fun

Mathematics is always fun. Vedic mathematics specifies a set of SUTRAS (formulae) that helps you to play with numbers.. mathematics made quicker and easier!

ALL FROM 9 AND THE LAST FROM 10 to perform instant subtractions

We simply take each figure in 357 from 9 and the last figure from 10.

1 0 0 0 - 3 5 7

(9-3) (9-4) (10-7)

6 4 3

So the answer is 1000 - 357 = 643

Using VERTICALLY AND CROSSWISE you do not need to the multiplication tables beyond 5 × 5.

Suppose you need 8 × 7

8 is 2 below 10 and 7 is 3 below 10.

Think of it like this:

82

73

56

You subtract crosswise 8-3 or 7 - 2 to get 5,the first figure of the answer.

And you multiply vertically: 2 x 3 to get 6,the last figure of the answer.

Multiplying numbers just over 100.

103 × 104 = 10712

The answer is in two parts: 107 and 12,

107 is just 103 + 4 (or 104 + 3), and 12 is just 3 x 4.

Similarly 107 × 106 = 11342

107 + 6 = 113 and 7 x 6 = 42

A quick way to square numbers that end in 5 using the formula BY ONE MORE THAN THE ONE BEFORE.

752 = 5625

752 means 75 × 75.

The answer is in two parts: 56 and 25.

The last part is always 25. The first part is the first number, 7, multiplied by the number "one more", which is 8:

so 7 × 8 = 56

Method for multiplying numbers where the first figures are the same and the last figures add up to 10.

32 × 38 = 1216

Both numbers here start with 3 and the last figures (2 and 8) add up to 10.

So we just multiply 3 by 4 (the next number up)

to get 12 for the first part of the answer.

And we multiply the last figures: 2 x 8 = 16 to get the last part of the answer.

And 81 x 89 = 7209

We put 09 since we need two figures as in all the other examples.

An elegant way of multiplying numbers using a simple pattern.

21 × 23 = 483

This is normally called long multiplication but actually the answer can be written straight down

using the VERTICALLY AND CROSSWISE formula.

We first put, or imagine, 23 below 21:

There are 3 steps:

(a) Multiply vertically on the left: 2 × 2 = 4.
This gives the first figure of the answer.

(b) Multiply crosswise and add: 2 × 3 + 1 × 2 = 8
This gives the middle figure.

(c) Multiply vertically on the right: 1 × 3 = 3
This gives the last figure of the answer.

And that's all there is to it.

Similarly 61 × 31 = 1891

6 × 3 = 18; 6 × 1 + 1 × 3 = 9; 1 × 1 = 1

Multiply any 2-figure numbers together by mere mental arithmetic!

If you want 21 stamps at 26 pence each you can easily find the total price in your head.

There were no carries in the method given above. However, there only involve one small extra step.

21 × 26 = 546

The method is the same as above except that we get a 2-figure number, 14, in the middle step, so the 1 is carried over to the left (4 becomes 5).

33 × 44 = 1452

There may be more than one carry in a sum:

Vertically on the left we get 12.

Crosswise gives us 24, so we carry 2 to the left and mentally get 144.

Then vertically on the right we get 12 and the 1 here is carried over to the 144 to make 1452.

Multiplying a number by 11.

To multiply any 2-figure number by 11 we just put the total of the two figures between the 2 figures.

$26 \times 11 = 286$

Notice that the outer figures in 286 are the 26 being multiplied.

And the middle figure is just 2 and 6 added up.

So $72 \times 11 = 792$

$77 \times 11 = 847$

This involves a carry figure because $7 + 7 = 14$

we get $77 \times 11 = 7147 = 847$.

$234 \times 11 = 2574$

We put the 2 and the 4 at the ends.

We add the first pair $2 + 3 = 5$ and we add the last pair:

$3 + 4 = 7$.

Method for diving by 9.

$23 / 9 = 2$ remainder 5

The first figure of 23 is 2, and this is the answer.

The remainder is just 2 and 3 added up!

$43 / 9 = 4$ remainder 7

The first figure 4 is the answer

and $4 + 3 = 7$ is the remainder - could it be easier?

Multiplying by 12 - shortcut

So how does the 12's shortcut work?

Let's take a look.

12×7

The first thing is to always multiply the 1 of the twelve by the number we are multiplying by, in this case 7.

So $1 \times 7 = 7$.

Multiply this 7 by 10 giving 70. (Why? We are working with BASES here.

Bases are the fundamentals to easy calculations for all multiplication tables.

To find out more check out our Vedic Maths ebook at www.vedic-maths-ebook.com

Now multiply the 7 by the 2 of twelve giving 14. Add this to 70 giving 84.

Therefore 7 × 12 = 84

Let's try another:

17 × 12

Remember, multiply the 17 by the 1 in 12 and multiply by 10 (Just add a zero to the end)

1 × 17 = 17, multiplied by 10 giving 170.

Multiply 17 by 2 giving 34.

Add 34 to 170 giving 204.

So 17 × 12 = 204

lets go one more

24 × 12

Multiply 24 × 1 = 24. Multiply by 10 giving 240.

Multiply 24 by 2 = 48. Add to 240 giving us 288

24 × 12 = 288

(these are Seriously Simple Sums to do aren't they?!)

Converting Kilos to Pounds

In this section you will learn how to convert Kilos to Pounds, and Vice Versa.

Let's start off with looking at converting Kilos to pounds.

86 kilos into pounds:

Step one, multiply the kilos by TWO.

To do this, just double the kilos.

86 × 2 = 172

Step two, divide the answer by ten.

To do this, just put a decimal point one place in from the right.

172 / 10 = 17.2

Step three, add step two's answer to step one's answer.

172 + 17.2 = 189.2

86 Kilos = 189.2 pounds

Universal Formula Mathematics

Find out what you didn t learn at school.

Ancient Knowledge that has been held secret... or hidden for thousands of years.

Jain

About Jain: Jain is his only name... he was born in Sydney to Lebanese parents. His father, a wealthy and successful businessman, migrated to Australia with his family in 1956. A long time meditator, Jain has always been drawn to the spiritual and mystical, he is fascinated by numbers and shapes. He has enjoyed a lifetime involvement with the Fibonacci Sequence and the 5 Platonic Solids which taps into the highly visual hemisphere of the Right Brain.

His work with Vedic Mathematics, a 2,500 year old Indian system of Mental, One-Line Arithmetic... is to empower the student so that they can perform mental calculations, in many cases... quicker than a calculator. Jain expands and demonstrates the real ability of your mind by showing you how to complete complex mathematics ... in your head! Jain reveals ancient yet simple Math formulas which allow ordinary people to perform complex equations.

At the same time he shows you how the world as we know it is more than we think... his teachings can for some people, bring about major shifts in the way we think about the world! Over the years, Jain has been devoted to the collection and theatrical education of Magic Squares, Magic Cubes and the Golden Ratio (PHI). In 1995, Jain taught Magic Square Art-forms to a conference of 100 maths teachers at the Australian Southern Cross University .

He has been guest speaker at school Math Camps throughout Australia. Also many Public Schools, Catholic Schools, Rudolf Steiner and Montessori Schools have employed him to rekindle the beauty of mathematics. He has recently completed filming for a DVD/TV documentary about Vedic Mathematics and Ancient Knowledge. Jain runs seminars on various forms of Ancient Knowledge, teaches children and adults (individuals and groups), records his discoveries having authored 8 books and produced several videos... and he continues his research into Sacred Geometry, Magic Squares, Platonic Solids, Fibonacci Sequences and their relationship with various atomic structures.

His passionate and ongoing commitment to share this incredible knowledge is furthered with an initial 6 month Australian Tour followed by 2 months USA Tour. The US Tour includes a special guest appearance at the Global Conference on Sacred Geometry in California (August 2004), where he has been invited to teach Vedic Mathematics, Golden Mean and Magic Squares. His travels continue with 3 x 1 month tours of Sweden, England , Nepal and India. He is compiling a database of people all over the world who have expressed interest to study with him and is developing internet also regional programs. If you feel like some enlightenment; want to experience Maths as Art, Maths as Science, Maths as History or develop your mental muscle with rapid mental calculations... come and experience these subjects which will expand your consciousness.

Universal Formula Mathematics

Due to an immense response from people all over the world, there is a great demand to know more about the Magic of Vedic Mathematics. Jain wrote an article: VEDIC MATHEMATICS REDISCOVERED for the Nexus Magazine, Oct/Nov issue 2003, and it has awakened many people to start questioning all the missing gaps and insufficiencies in the current mathematics curriculum. It also has motivated Jain to begin his Australia Tour until August before he travels to America then Europe and India. Do your children really understand the fragmented and confusing mathematical data taught to them?

Would you be interested in another method that boosted their confidence, increased their memory skills and is presented in a fun and exciting manner? After this course of study, you will never multiply, divide or add in the same manner again. And no more Times Tables! An understanding of the 16 basic Sutras or "Word Formulae" solves all known mathematical problems by using an advanced and highly intelligent system of MENTAL, ONE LINE ARITHMETIC used by the Hindus 2,000 years.

This system was reconstructed by Bharati Krsna Tirthaji (1884-1960, aka Shankarcharya of Puri) who was invited by Paramahansa Yogananda to take this knowledge, for the first time, to the western world, in 1958. The Beatle's guru: Maharishi Mahesh Yogi, who introduced Transcendental Meditation to the west, was also a student of this master and currently teaches this system in India in the spiritual Maharishi schools, whose teenage students are highly distinguished mathematical geniuses. Learn also how the Hindu Invention of Zero (and the decimal system) led to modern technological advancements. In this one day workshop you will know how to accomplish rapid calculations, mentally.

No more Calculators which make the brain lazy. The brain is a mental muscle and needs to be exercised. Jain predicts that if we continue to teach children with an over-emphasis of using calculators in the class-room, over a 20 year period, the Global Brain will deteriorate. Most children are visual, and the ability to tap into 'Pattern Recognition' is the key to rapid mental calculation. There is another similar system known as the Trachtenberg method, but this Vedic System successfully harnesses the mental "Path of Least Resistance" and is distinctly the superior system.

The Divine Proportion

Learn why the shape of the Pine Cone is optically similar to the Human Heart, why we are awe-struck when we view sacred architecture like the Parthenon, why we are attracted to the proportions of the famous Mona Lisa. Essentially, the human body is in resonance with the Living Mathematics of Nature. A day for exploring the hidden mysteries within the 5 Platonic Solids and the 13 Archimedean Solids. What is the importance of the Star Tetrahedron (the 3-Dimensional version of the Star of David) having 24 faces and 24 edges? How does this link to the 24 edges of the Cuboctahedron, the compressible and alchemical shape that was revered by Buckminster Fuller (who designed the first geodesic domes).

A lesson in x-raying the Fibonacci Sequence : 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144 etc. to discover where the infinite phi expression has its underlying rhythm, a distinct periodicity of 24 recurring digits that can not be seen by the Western Mathematical Eye but only by the Truth of Vortex Mathematics expressed as Vedic Mathematics! (Really this Knowledge predates the Vedas and Atlantis and is better referred to as Galactic Mathematics).

Bridging Physics to Metaphysics by understanding the work of Charles Leadbeater and Annie Besant who, 100 years ago, drew all known atomic structures of the elements of the periodic table. In fact some recently discovered isotypes have been drawn 100 years ago! Having associated with yogis, this Pair of Clairvoyant Chemists were also able to successfully describe the moons of Jupiter, confirmed now by NASA!

This material actually validates Jain's life's work:that when the numbers of certain Magic Squares, like the Magic Square of 3x3*, which is the centre of the Tibetan Calendar, when tiled or tessellated into a larger matrix actually shows the shadow form of the 3-Dimensional view of the Atomic Structure of Diamond-Lattice! This material shakes the whole foundations of the current Western mathematics curriculum, will rewrite our current world view on Mathematics and will require a new definition of the Golden Mean: that its decimal does carry on infinitely but within its infinity there is recursive or self-similar beauty. Scientists like Marco Rodin wind toroidal coils in sync with this recursion or rhythm or pulse or pattern of 24 digits to get more output than their input! The sum of these 24 digits is 108 (108 degrees being the external angles of the pentagram and the number of beads in a rosary) which is sonically disguised as the GAYATRI MANTRA, the most famous Eastern prayer for Enlightenment.

Magic Square

4	9	2
3	5	7
8	1	6

A fascinating day that will help you to remember this Lost Knowledge of the PHI CODE that is already morphologically and geometrically encoded in your bio-magnetic and bio-electrical fields. Ultimately, this Pythagorean Knowledge is not an intellectual process, but rather that these essential geometries are invisibly constructed and nested within the Heart as the Centre of a greater Galactic Grid connecting us to all Memory of all Universes and Atomic Levels. Magic Squares, Vedic Mathematics and the Phi Ratio (1:1.618) : Why have they not been taught in your maths classes ? ... because they are keys to your ascension process..

it became possible to note higher numerals with limited charecters.

In the earlier Roman and Babylonian systems of numeration, a large number of characters were required to denote higher numerals. Thus enumeration and computation became unwieldy. For instance, as E the Roman system of numeration, the number thirty would have to be written as X: while as per the decimal system it would 30, further the number thirty three would be XXXIII as per the Roman system, would be 33 as per the decimal system. Thus it is clear how the introduction of the decimal system made possible the writing of numerals having a high value with limited characters. This also made computation easier.

Apart from developing the decimal system based on the incorporation of zero in enumeration, Brahmagupta also arrived at solutions for indeterminate equations of 1 type ax2+1=y2 and thus can be called the founder of higher branch of mathematics called numerical analysis. (Brahmagupta's treatise Brahma-sputa-siddhanta was translated into Arabic under the title Sind Hind).

For several centuries this translation mained a standard text of reference in the Arab world. It was from this translation of an Indian text on Mathematics that the Arab mathematicians perfected the decimal system and gave the world its current system of enumeration which we call the Arab numerals, which are originally Indian numerals.

Nikhilam Navatashcaramam Dashatah

Nikhilam Navatashcaramam Dashatah: All from 9 and the last from 10.

Nikhilam Navatashcaramam Dashatah is the second sutra of Vedic mathematics. Its corollary is Sisyate Sesasamjnah.

Nikhilam multiplication can save time when multiplying numbers that are both near base 10, or both near base 100, or both near base 1000, etcetera.

Nikhilam division can be used to quickly divide any number (regardless of size) by a number that is near a base 10, base 100, etc. (such as the numbers 9, 98, 996, etc.)

What follows is a brief and incomplete summary of the math shortcuts this sutra contains:

Nikhilam multiplication using base 10, base 100, base 1000, etc.

The easiest way to explain this is to show two examples:

Rounding to base-10: If you wanted to multiply 14 by 13 you would start by adding the two numbers and subtracting 10.

$$14 + 13 = 27$$

$$27 - 10 = 17.$$

Add one zero (for the one zero in base 10) to the end: 170.

Now calculate the difference between 14 and 13 and their common base of ten, which would be the number 10.

14 is 4 away from 10; 13 is 3 away from 10.

Multiply 4 and 3. This equals 12.

Add the 12 to the number we got before (170).

12 + 170 equals 182.

Thus 14 x 13 equals 182.

Rounding to base-100: If you wanted to multiply 97 by 89, for example, you would start by adding the two numbers (186) and subtracting 100.

$$186 - 100 = 86.$$

Now add the two zeroes (for the two zeroes in base 100) to the end: 8600.

Now calculate the difference between the two numbers and their common base and multiply those two numbers.

$$100 - 97 = 3$$

$$100 - 89 = 11$$

$$3 \times 11 = 33.$$

Add the 33 to 8600 for the answer.

$$97 \times 89 = 8633.$$

Nikhilam division using base 10, base 100, base 1000, etc.

Nikhilam division seems, at first glance, too complicated to save time, but is actually surprisingly fast and simple to do. Below are examples of some (but not all) applications of Nikhilam division:

Dividing any two-digit number by 9: Example: 53 divided by 9. the first digit (5) is the quotient. Now add the first and second digit: 5 + 3 = 8. The remainder is 8. Simple as that.

If the first and second digit add up to more than nine, you subtract 9 from the remainder and add 1 to the quotient. Example: 69 divided by 9. The quotient (at first glance) appears to be 6. But 6 + 9 = 15. You subtract 9 from 15 to get the real remainder (6) and add one to the quotient. Thus, the quotient is 7 and the remainder is 6.

Dividing any three-digit number by 9: This one might require paper and pen but is also quite easy.

Example: 412 divided by 9.

The first digit of the quotient will be the same as the first digit of the dividend: 4.

Now add the first two digits of the dividend: 4 + 1 = 5

Place this number (5) after the first digit of the dividend (4): 45

The quotient is 45.

To find the remainder, add all three digits of the dividend:

4 + 1 + 2 = 7

The quotient is 45 and the remainder is 7. If the remainder is more than 9, add one to the quotient and subtract 9 from the remainder.

Dividing any four-digit number by 9: Example: 1234 divided by 9.

The first digit of the quotient will be the same as the first digit of the dividend: 1

Add the first two digits (1 + 2 = 3) and place that after the first digit (1). Now we have 13.

Add the first three digits (1 + 2 + 3 = 6) and place that after the 13. Now we have 136. This is the quotient.

The remainder will be all for digits added together.

1 + 2 + 3 + 4 = 10

But wait, the remainder can't be more than 9, so subtract 9 from the remainder and add one to the quotient.

The quotient is 137 and the remainder is 1.

Nikhilam division can also be used to divide very large numbers by a number that is near a base, such as 98, 984, 897, etc., but this gets a little more complicated.

Vedic Mathematics: The Ancient Indian Knowledge

Indian civilization has surprised academicians time and again with simple age old techniques for solving complex problems. Vedic Mathematics, derived from the Ganita Sutra in the Vedas is one such technique. Vedic Mathematics is the name given to the ancient system of Mathematics which was rediscovered from the Vedas between 1911 and 1918 by Sri Bharati Krsna Tirthaji (1884 - 1960).

In the beginning of the twentieth century, when there was a great interest in various Sanskrit texts in Europe, some scholars ridiculed certain texts which were titled GANITA SUTRA, which means mathematics.

They could not decipher any mathematics in the translations and therefore dismissed the texts as rubbish. Bharati Krsna, who himself was a scholar of Sanskrit, Mathematics, History and Philosophy, studied these texts and after lengthy and careful investigation was able to reconstruct the mathematics of the Vedas.

Bharati Krsna wrote sixteen volumes expounding the Vedic system but these were unaccountably lost and when the loss was confirmed in his final years he wrote a single book - Vedic Mathematics. It was published in 1965, five years after his death.

According to his research all of mathematics is based on sixteen Sutras, or word - formulae.

For example, 'Vertically and Crosswise' is one of these Sutras. These formulae describe the way the mind naturally works and are therefore a great help in directing the student to the appropriate method of solution.

Perhaps the most striking feature of the Vedic system is its coherence. Instead of a hotchpotch of unrelated techniques the whole system is beautifully interrelated and unified.

The multiplication method, for example, is easily reversed to allow one-line divisions and the simple squaring method can be reversed to give one-line square roots. And all are very easy to understand. This unifying quality is very satisfying; it makes mathematics easy and enjoyable and encourages innovation.

In the Vedic system difficult problems or huge sums can often be solved immediately by the Vedic method. These striking and beautiful methods are just a part of a complete system of mathematics, which is far more systematic than the modern system. Vedic mathematics manifests the coherent and unified structure of mathematics and the methods are complimentary, direct and easy.

The simplicity of Vedic Mathematics means that calculations can be carried out mentally (though the methods can be written down).

There are many advantages in using a flexible, mental system. Pupils can invent their own methods; they are not limited to the one correct method. This leads to more creative, interested and interesting pupils.

Interest in the Vedic system is growing in education where mathematics teachers are looking for something better and finding Vedic system is the answer. Research is being carried out in many areas including the effects of learning Vedic Mathematics on children, developing new, powerful but easy applications of the Vedic Sutras in geometry, calculus, computing, etc.

But the real beauty and effectiveness of Vedic Mathematics cannot be fully appreciated without actually practicing the system. One can then see that it is perhaps the most refined and efficient mathematical system possible.

Why do We Need to Combine Pure and Vedic Mathematics?

Schools all over the world utilize pure mathematics for their curriculum. Therefore an in-depth knowledge of pure mathematics is essential from the examination point of view. Unfortunately the mathematics that is taught is most schools and colleges lack flexibility and therefore become 'boring' to the students.

On top of that many teachers lack the insight and knowledge required to teach the subject. Fixed methods are also used for all operations thereby making the process of calculation lengthy and tiresome.

The right combination of Vedic and pure mathematics ensures correct understanding, extreme flexibility and an in-depth knowledge of the subject, thereby making calculations extremely rapid and interesting.

This combination can be utilized for simple addition and subtraction, and also for more difficult operations like calculus, and algebra. Many of these operations can be done mentally. Therefore this can be used for students of all ages and standards. There are also wonderful methods for checking the sums.

Utilizing this method, the student will become faster and more accurate in all-mathematical procedures.

Western vs. Vedic Astrology—Predictive Methodology

As mentioned in another article astrological calculations for planetary longitudes differ in Western and Vedic astrology. Western system uses so called moving zodiac or coordinate system called Sayana while Vedic system uses fixed or Nirayana system.

But for astrological predictions using the basic planetary coordinates there is a gulf of difference between Western and Vedic system. In Western system the intricacies are not there and interpretation of planetary interactions are limited, while in Vedic system the tools and the depth of application is limited only by the depth of ones knowledge and interest with many cross checking and confirmation tests.

In Western system all the planets including those discovered in 19th Century - viz Uranus, Neptune and Pluto are generally used. In a mixed system some Indian astrologers use Sayana and these extra Saturn planets with the names of Indra Varuna and Yama.

Vedic system uses mainly the two luminaries and five other planets but include two "CHAYA" shadow planets viz

Rahu and Ketu. Their importance can be judged from Physics definition of UMBRA and PENUMBRA points when two luminaries interact. The importance of these becomes evident by the fact that an eclipse occurs whenever luminaries and these fall in a straight line.

In interpretation Western system uses only angular distances between planets - treating 120 and 60 as good and 90 and 45 as bad. The others like 180, 72, 30, 0, etc., are also considered.

The timing also is very static - only progressions are taken as 1 degree = I year of life, 1 day = I year of life, etc., *i.e.*, whenever say a planet is in 14 degrees of a house and another at say 24 of same house - at the age of 10 both are conjunct.

Thus by these progressions the timing is calculated and the type of angular distance determines the event. The houses are of equal duration, which does not take the latitude effect of place. The Gochara or effect of current planetary positions is accounted by the angles they form with birth planets. Thus over all the methods of interpretations of western system is simple arithmetic and static.

In contrast Vedic system introduces a unique frame of reference called Lagna or ascendant, which is the Eastern horizon point at the time of birth.

Thus all the spatial coordinates of place of birth are taken in each birth. Lagna forms the starting point and from there different bhavas are defined to account for different aspects of our life. The planetary relations are also classified as benefic/evil, naturally friendly/foe and dynamically friendly/foe, etc.

The houses or bhavas are also classified as good and bad. Synthesis and analysis are basic tools in any scientific study. In Vedic astrology also such tools are extensively used. The bhavas are not of equal duration but astronomical effects are accounted by Sripathi method of Bhava Sphutam. The strength of planets is also calculated by many methods including graha balas, which take into account their absolute positions relative positions, etc.

Thus planets have complex properties like naturally good/bad, positionally good/bad and different strengths to do that good or bad. The rules are also dynamic in that for many rules have exceptions where the rule has to be over ruled. When ever a gross examination does not answer a complex question in a scientific field one goes to microscopic examination. Having AMSA charts where the house is divided into microscopic units - uses same principle.

In this one go in depth to a particular activity like profession marriage, etc. Thus one can devise charts where a house is divided to 1/3,1/4, 1/5, 1/6, 1/7,1/8 1/9,1/10, 1/11, 1/12, 1/16, 1/20, 1/27, 1/30 an 1/60 - each representing a different aspect of life. The timing is also followed by what is called Dasa system — in fact many dasa systems like Vimsottari, Ashtottari, etc., exist and one has to apply correct dasa system.

The Gochara is also very finely tuned by different methods like present-day movements of planets vis a vis birth position of moon. In fact a more complex system exists called Ashtakavarga which is a 12 by 8 matrix - *i.e.*, the position of 7 planets and lagna in 12 houses at birth interacting with present day planetary positions of 12 by 8 matrix.

The mathematical tools used in the evaluation of these is mind boggling - if we note that the evaluation rules of Matrix are hardly 3 centuries old - the evaluation rules of Ashtakavarga - like if there is a zero in a row (Column) cancel that, Subtract smallest number from highest number, etc., proves the depth of Vedic mathematics used - which are at least thousands of years old.

The Gochara is not limited to these and has other methods like Nilakhanthas solar return horoscope or Tajaka system to give accurate yearly results. While all these go under the head of Parasara system we have the complex Jaimini system with its complex rules. Thus Vedic astrology is a ocean of nectar and any one of us can enjoy only a drop of the same as per our luck and karma. It is a holistic approach to satisfy achieving of all purshardhas— of Dharma, Ardha, Kama and Moksha.

Finally if one is predicting based on divine intuition it is immaterial if one is following East or Western method or if one is born white, black, yellow or brown. Astrology is a divine science and only needs divine blessing and all calculations and interpretations are only road signs to follow the path - a means but not the ends.

Bibliography

A B Chace, L S Bull, H P Manning and R C Archibald: *The Rhind Mathematical Papyrus,* Oberlin, Ohio, 1927.

A.L. Basham: *The Wonder That Was India*, Rupa & Co., Calcutta, 1967.

Aaboe, Asger: *Episodes from the Early History of Mathematics*, New York, 1964.

Amma, Saraswarti: *Geometry in Ancient and Medieval India*, Motilal Banarsidas, 1979.

Armstrong, Robert G.: *Yoruba Numerals*, London, Oxford University Press, 1962.

Arnett, William S.: *The Predynastic Origin of Egyptian Hieroglyphs*, Washington, University Press of America, 1982.

Ascher, Marcia: *Ethnomathematics*, Pacific Grove, CA: Brooks/Cole, 1991.

Bag, A. K.: *Mathematics in Ancient and Medieval India*, Varanasi: Chaukhambha Orientalia, 1979.

Barnard, F. P.: *The Casting-Counter and the Counting Board. A Chapter in the History of Numismatics and Early Arithmetic*, Oxford, Oxford University Press, 1916.

Barrow, John D.: *Pi in the Sky*, Oxford, Clarendon Press, 1992.

Basham, A. L.: *The Wonder That Was India*, Calcutta, Rupa & Co., 1967.

Beckmann, Petr: *A History of Pi*, New York, St. Martin's Press, 1974.

Bell, Eric T.: *The Magic of Numbers*, New York, McGraw-Hill, 1946.

Berlin, Brent: Tzeltal Numeral Classifiers, The Hague, Mouton, 1968.

Bharati Krishna Tirthaji Majaraja.: *Vedic Mathematics*. Delhi, Motilal Banarsidass, 1988.

Bidyaranya, Swami: *History of Hindu Mathematics*,Bombay, Asia Pub. House, 1962.

Bischoff, Bernard: *Latin Palaeography*, Cambridge, Cambridge University Press, 1990.

Bonfante, Larissa: *Etruscan*. Berkeley, University of California Press, 1990.

Bowditch, Charles P.: *The Numeration, Calendar Systems and Astronomical knowledge of the Mayas*, Cambridge, Cambridge University Press, 1910.

Brainerd, Charles J.: *The Origins of the Number Concept*, New York, Praeger, 1979.

Brunschwig, Jacques and Geoffrey E.R. Lloyd:. *Greek Thought: A Guide to Classical Knowledge*, Cambridge, Harvard University Press, 2000.

Bunt, L. N. H., Jones, P. S., & Bedient, J. D.: *The Historical Roots of Elementary Mathematics*, New York, Dover, 1988.

Chattopadhyaya, D. P.: *Mathematics, Astronomy, and Biology in Indian Tradition: Some Conceptual Preliminaries*, New Delhi, Project of History of Indian Science, Philosophy, and Culture, 1995.

Clawson, Calvin: *The Mathematical Traveller*, New York, Plenum Press, 1994.

Closs, Michael P.: *Native American Mathematics*, Austin, University of Texas Press, 1986.

Conant, Levi L.: *The Number Concept*, New York, MacMillan, 1896.

Crossley, John N: *The Emergence of Number*, Singapore, World Scientific, 1987.

Crump, Thomas: *The Anthropology of Numbers*, Cambridge, Cambridge University Press, 1990.

Dantzig, Tobias: *Number, the Language of Science*, London, George Allen and Unwin, 1940.

De Villiers, Melius: *The' Numeral-Words: Their Origin, Meaning, History and Lesson*, London, Witherby, 1923.

Dehaene, Stanislas: *The Number Sense*, New York, Oxford University Press, 1997.

Dilke, Oswald Ashton Wentworth: *Mathematics and Measurement*, Berkeley, CA: U. of Cal. Press, 1987.

Eves, Howard: *An Introduction to the History of Mathematics*, New York, Rinehart and Company Inc., 1953.

Flegg, Graham: *Numbers: Their History and Meaning*, London, André Deutsch, 1983.

Fowler, David: *The Mathematics of Plato's Academy*, Oxford, Clarendon, 1999.

Fuson, K.C.: *Children's Counting and Concepts of Number*, New York, Springer-Verlag, 1988.

Ganeri, Anita: *The Story of Numbers and Counting*, New York, Oxford University Press, 1996.

Gokhale, Shebhana Laxman: *Indian Numerals*, Poona, Deccan College, 1966.

Griffith, Francis Llewellyn: *Hieratic Papyri from Kahun and Gurob*, London, Bernard Quaritch, 1898.

Grover, Sudarshan: *History of Development of Mathematics in India*, Delhi, Atma Ram & Sons, 1994.

Haldane, John Burdon Sanderson: *Science and Indian Culture*, Calcutta, New Age Publishers, 1965.

Halliwell, James Orchard: *Rara Mathematica*, London, J.W. Parker, 1839.

Herbert Meschkowski: *Ways of Thought of Great Mathematicians*, Holden-Day Inc., San Francisco, 1964.

Hogben, Lancelot: *Mathematics for the Million*, New York, W. W. Norton, 1937.

Howard Eves: *An Introduction to the History of Mathematics*, Rinehart and Company Inc., New York, 1953.

Ifrah, Georges: *From One to Zero: A Universal History of Numbers*, New York, Viking Penguin, 1985.

Jagadguru Swami Shri Bharati Krishna Tirthaji Maharaja: *Vedic Mathematics*, Motilal Banarsidass, Delhi, 1988.

Jaggi, O. P.: *Science and Technology in Medieval India*, New Delhi, Atma Ram & Sons, 1977.

Kline, Morris: *Mathematical Thought from Ancient to Modern Times*, New York, Oxford U. Press, 1990.

Kuppuram, G & K. Kumudamani: *History of Science and Technology in India*, Delhi, Sundeep Prakashan, 1990.

Lancy, David F.: *Cross-Cultural Studies in Cognition and Mathematics*, New York, Academic, 1983.

Marcus, Joyce: *Mesoamerican Writing Systems*, Princeton, Princeton University Press, 1992.

Marshack, Alexander: *The Roots of Civilization*, New York, McGraw-Hill, 1972.

Martzloff, Jean-Claude: *A History of Chinese Mathematics*, New York, Springer, 1997.

McLeish, John: *The Story of Numbers*, New York, Fawcett Columbine, 1991.

Menninger, Karl: *Number-Words and Number-Symbols*. London, MIT, 1969.

Murthy, T. S. Bhanu: *A Modern Introduction to Ancient Indian Mathematics*, Wiley Eastern Ltd., New Delhi, 1992.

Neugebauer, Otto and A. Sachs: *Mathematical Cuneiform Texts*, New Haven, Yale University Press, 1945.

Neugebauer, Otto: *The Exact Sciences in Antiquity*, Princeton, Princeton University Press, 1952.

North, John: *The Norton History of Astronomy and Cosmology*, New York, W.W.Norton, 1995.

Pandit, M. D.: *Mathematics as known to the Vedic Samhitas*, Delhi, Sri Satguru Publications, 1993.

Pappas, Theoni: *The Magic of Mathematics*, San Carlos, Wide World Publishing / Tetra, 1994.

Parpola, Asko: *Deciphering the Indus Script*, Cambridge, Cambridge University Press, 1994.

Peet, T. Eric: *The Rhind Mathematical Papyrus*, London, British Museum, 1923.

Piaget, Jean: *The Child's Conception of Number*, New York, W.W. Norton, 1965.

Pullan, J.M: *The History of the Abacus*, New York, Praeger, 1968.

Rao, S. Balaachandra: *Indian Mathematics and Astronomy*, Bangalore, Jnana Deep Publications, 1994.

Restivo, Sal: *The Social Relations of Physics, Mysticism and Mathematics*, Dordrecht, Kluwer, 1983.

Robins, G. and C. Shute: *The Rhind Mathematical Papyrus*, London, British Museum, 1987.

Russell, Bertrand: *The Principles of Mathematics*, Cambridge, Cambridge University Press, 1903.

Salomon, Richard: *Indian Epigraphy*, New York, Oxford University Press, 1998.

Saraswati Amma: *Geometry in Ancient and Medieval India*, Motilal Banarsidas, 1979.

Sarton, George: *The Study of the History of Mathematics*, Cambridge, Cambridge University Press, 1936.

Satterthwaite, Linton, Jr.: *Concepts and Structures of Maya Calendrical Arithmetics*, Philadelphia, University of Pennsylvania, 1947.

Schaaf, W.L.: *Mathematics, Our Great Heritage*, New York, Harper and Row, 1948.

Schimmel, Annemarie: *The Mystery of Numbers*, New York, Oxford University Press, 1993.

Scriba, C.J.: *The Concept of Number*, Zurich, Mannheim, 1968.

Seidenberg, A.: *The Zero in the Mayan Numerical Notation*, Austin, University of Texas Press, 1986.

Smeltzer, Donald: *Man and Number*, New York, Emerson, 1959.

Smith, D. E.: *History of Mathematics*, New York, Dover Publications Inc., 1951.

Srinivasiengar, C. N.: *The History of Ancient Indian Mathematics*. Calcutta, World Press, 1967.

Struik, Dirk J.: *A Concise History of Mathematics*, New York, Dover, 1987.

Thompson, Sir J. Eric S.: *Maya Hieroglyphic Writing: An Introduction*, Norman, University of Oklahoma Press, 1971.

Todd, R.R., P.J. Barber, and D. Jones: *The Internal Representation of Number: Analogue or Digital?*, Oxford, Clarendon, 1987.

Urton, Gary: *The Social Life of Numbers*, Austin, University of Texas Press, 1997.

Volodarsky, A.I.: *Mathematics in Ancient India*, Tokyo, Science Council of Japan, 1974.

Woolner, Alfred C.: *Introduction to Prakrit*, Calcutta, Baptist Mission Press, 1917.

Index

A

Accounts, 40.
Achievement, 70, 111.
Addition, 3, 11, 12, 21, 26, 51, 74, 103, 114, 127, 133, 139, 141, 144, 151, 156, 165, 166, 177, 224, 239.
Advantages, 2, 238.
Algebra, 2, 22, 32, 51, 52, 54, 102, 105, 117, 143, 177, 187, 223, 225, 226, 227, 228, 229, 230, 232, 239.
Algorithm, 114, 115, 226, 227, 229, 230.
Algorithms, 181.
Anurupyena, 2, 141, 144, 150.
Apastamba, 230.
Application, 25, 51, 66, 97, 100, 109, 112, 114, 133, 134, 166, 176, 197, 214, 216, 225, 227, 239.
Approach, 51, 59, 65, 110, 165, 212, 213, 242.
Arabic Numeral, 232.
Architecture, 36, 41, 42, 74, 88, 94, 101, 107, 129, 226.
Arithmetic, 2, 22, 29, 30, 31, 32, 34, 35, 52, 95, 105, 112, 143, 167, 168, 169, 170, 177, 179, 186, 188, 194, 223, 225, 227, 240.
Arithmetical Operations, 58.
Art, 32, 35, 36, 38, 39, 40, 41, 51, 100, 186.
Aryabhatta, 105, 228.
Aryans, 182, 183.
Astrology, 102, 184, 188, 239, 240, 242.
Astronomer, 22, 172, 228, 229, 232.
Astronomical Text, 232.
Astronomy, 34, 101, 105, 129, 172, 188, 226, 227.

B

Baudhayana, 230.
Bhagawad Gita, 31.
Bhaskaracharya, 187, 228.
Brahma, 62, 74, 75, 80, 81, 82, 84, 85, 87, 88, 89, 92, 93, 95, 105, 232, 233.
Brahmagupta, 105, 232, 233.
Brahmans, 27.
Buddhism, 28.
Buddhist, 230, 232.
Business, 53, 97.

C

Calculations, 2, 24, 29, 30, 33, 50, 51, 55, 112, 125, 128, 168, 169, 171, 175, 188, 220, 222, 223, 224, 226, 227, 238, 239, 242.

Calculator, 29, 31, 32, 47, 112, 168, 169, 170, 222, 225.

Calculus, 2, 21, 22, 32, 51, 52, 53, 54, 55, 102, 103, 122, 129, 177, 207, 223, 224, 226, 238, 239.

Characters, 233.

Christian, 40, 228.

Civilization, 31, 51, 169, 236.

Commission, 184.

Communication, 223, 231.

Community, 38, 40, 48, 49, 184.

Company, 98, 100.

Complementary, 2, 64.

Computation, 105, 227, 228, 229, 230, 231, 233.

Concept, 22, 32, 35, 41, 47, 65, 66, 68, 81, 94, 172, 224, 226, 231, 232.

Consider, 4, 12, 13, 14, 15, 17, 19, 34, 111, 121, 125, 127, 133, 134, 135, 138, 140, 141, 142, 146, 149, 150, 157, 159, 162.

Contribution, 186, 226, 229.

Cosmology, 36, 37, 39, 104.

Creation, 22, 32, 39, 40, 41, 85, 87, 106, 172, 173, 187, 188.

Criticism, 110, 112, 187.

Cubics, 11.

Culture, 52, 53, 107, 182, 183, 232.

D

Dalai Lama, 170.

Deceptions, 98.

Decimal Places, 27, 106, 133.

Decimal System, 31, 35, 232, 233.

Denominator, 4, 8, 17, 19, 117, 118, 119, 120, 121, 128, 134, 135, 140, 142, 146.

Department, 181.

Development, 2, 54, 58, 143, 170, 181, 186, 223, 227.

Dictionary, 50, 230.

Digital Sums, 26, 177.

Digits, 4, 5, 6, 23, 24, 26, 33, 43, 47, 49, 50, 72, 126, 127, 128, 133, 135, 137, 139, 141, 149, 153, 157, 158, 159, 160, 161, 167, 173, 174, 177, 178, 189, 190, 191, 192, 193, 195, 225, 235, 236.

Dimensions, 24, 36, 37, 38, 41, 58, 69, 73, 75, 80, 81, 82, 83, 86, 88, 91, 95, 175, 183.

Disciplines, 60, 61.

Division, 31, 51, 52, 53, 55, 71, 75, 93, 105, 115, 122, 128, 129, 133, 134, 135, 136, 137, 142, 146, 148, 152, 161, 165, 169, 195, 234, 235, 236.

E

Economy, 107, 175.

Education, 22, 30, 35, 107, 109, 110, 112, 171, 178, 181, 182, 187, 238.

Ekadhikena Purvena, 3, 131, 133, 145, 146.

Energy, 179.

Equations, 8, 10, 11, 12, 30,

55, 60, 99, 120, 129, 137, 138, 139, 156, 208, 233.
Evidence, 73, 97, 182, 183.
Expansion, 71, 117, 118.

F

Formulas, 1, 9, 19, 22, 24, 27, 30, 35, 54, 55.
Foundations, 24, 33, 47, 175, 186, 223.
Fractions, 9, 10, 111, 118, 119, 120, 122, 129, 134, 137, 146, 147, 194, 225.

G

Ganita Sutras, 58, 60, 64, 73, 170.
Gayatri Mantra, 33, 47, 194.
Generation, 33, 64, 170, 171.
Geometric, 40, 58, 59, 60, 61, 72, 75, 76, 78, 79, 80, 81, 82, 83, 84, 85, 87, 89, 91, 93, 227, 230.
Geometry, 2, 22, 32, 37, 41, 44, 46, 47, 49, 51, 53, 54, 60, 61, 95, 102, 143, 177, 188, 225, 226, 229, 238.
Glimpses, 57.
Govardhan Math, 170.
Government, 58, 107, 181, 226.

H

Hinduism, 223.

I

Illusion, 231.
Improvement, 220.
Indian Culture, 53.
Indian Mathematics, 112, 187, 227, 229.
Indian Science, 184.
Information, 64, 97, 98.
Innovation, 1, 54, 143, 237.
Institute, 59, 93, 102, 184.
Institutions, 184, 194.
Insurance, 97, 98.
Integration, 118, 129, 198, 199, 200, 202, 204, 205, 206, 208, 210, 211, 213, 216, 217, 218, 233.
Interest, 2, 19, 20, 50, 58, 102, 129, 130, 237, 238, 239.
Intuition, 34, 54, 143, 242.

J

Jesus, 38, 40, 228.
Jyotish, 106.

K

Knowledge, 22, 27, 28, 31, 32, 34, 35, 36, 38, 39, 42, 43, 47, 48, 49, 60, 61, 62, 73, 74, 75, 76, 77, 78, 79, 80, 83, 87, 88, 89, 90, 94, 95, 100, 101, 104, 105, 106, 107, 111, 112, 129, 131, 132, 165, 167, 170, 171, 172, 177, 179, 180, 185, 228, 230, 236, 238, 239.
Krishna, 1, 20, 27, 31, 54, 57, 60, 64, 81, 87, 95, 114, 133, 169, 178.

L

Language, 30, 36, 38, 39, 44, 46, 47, 61, 81, 85, 104, 111, 170, 181, 183, 230.

Law, 35, 106, 107, 165, 171, 175.

Literature, 33, 58, 73, 77, 80, 106, 110, 170, 226, 227.

M

Magic Squares, 36, 37, 38, 39, 40, 44, 46, 49.

Manasara, 73, 74, 75, 78, 81, 87, 88, 89, 90, 91, 93, 94, 95.

Manava, 230.

Mantras, 58, 61, 64, 80, 194.

Mathematical Data, 29, 168.

Mathematical Problems, 2, 22, 30, 32, 35, 59, 101, 143, 167, 168, 177, 179, 194, 223, 225.

Mathematician, 22, 33, 34, 52, 172, 179, 187, 188, 228, 229, 231, 232.

Mathematics, 1, 2, 18, 19, 20, 21, 22, 24, 25, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 42, 43, 44, 47, 50, 51, 52, 53, 54, 55, 57, 58, 59, 60, 61, 64, 65, 69, 70, 71, 73, 74, 75, 76, 81, 90, 95, 97, 98, 99, 100, 101, 102, 105, 106, 109, 110, 111, 112, 114, 129, 130, 131, 140, 143, 164, 165, 166, 167, 168, 169, 170, 171, 172, 175, 176, 177, 178, 179, 180, 181, 186, 187, 188, 194, 195, 197, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 233, 236, 237, 238, 239, 241.

Maya, 231.

Measurement, 88, 95, 229.

Mental Mathematics, 53, 222, 223.

Methodology, 239.

Methods, 1, 2, 50, 51, 52, 53, 54, 55, 102, 114, 129, 134, 150, 165, 169, 179, 180, 181, 187, 188, 194, 217, 218, 222, 224, 226, 229, 237, 238, 239, 240, 241.

Money, 107, 164, 179.

Multiplication, 1, 15, 25, 26, 50, 51, 52, 54, 72, 126, 129, 133, 134, 135, 136, 137, 141, 146, 148, 152, 154, 160, 165, 166, 167, 172, 176, 177, 178, 194, 195, 234, 237.

Multiplications, 47, 133, 134, 139, 163, 225.

Multiply, 4, 5, 6, 13, 15, 16, 17, 26, 29, 30, 32, 51, 54, 55, 72, 114, 117, 125, 126, 128, 134, 135, 141, 142, 146, 147, 151, 161, 164, 165, 167, 168, 170, 172, 175, 178, 188, 189, 192, 193, 224, 225, 234, 235.

N

Nature, 39, 41, 42, 44, 61, 64, 77, 89, 90, 93, 104, 107, 165, 166, 171, 185.

Nirvana, 232.

Numbers, 4, 11, 13, 14, 22, 23, 24, 25, 27, 29, 32, 34, 36, 37, 38, 39, 40, 43, 46, 60, 63, 66, 67, 69, 70, 72, 104, 112, 114, 115, 118, 120, 125, 126, 127, 128, 129, 133, 136, 137, 138, 141, 146, 147, 148, 150, 151, 152, 157, 158, 160, 161, 165, 166, 168, 170, 172, 173, 174, 175, 176, 180, 187, 188, 189, 190, 191, 192, 194, 195, 225, 230, 234, 235, 236.

O

Observation, 34.
Operations, 31, 51, 52, 58, 60, 133, 134, 168, 169, 194, 238, 239.
Organisation, 61, 62, 68, 69, 70, 73, 76, 87, 89, 90.

P

Philosophy, 19, 34, 101, 129, 182, 226, 231, 232, 237.
Pi, 27, 31, 106, 133, 169.
Pineal Gland, 33, 47.
Planets, 43, 105, 239, 240, 241.
Platonic Solids, 42, 44, 45, 48.
Polynomials, 112, 113, 114, 115, 118, 122.
Positions, 170, 240, 241.
Power, 5, 41, 61, 62, 106, 107, 117, 118, 125, 127, 128, 136, 157, 158, 159, 200, 202.
Principles, 57, 143, 154, 194.
Problems, 1, 2, 22, 29, 30, 32, 33, 35, 49, 51, 54, 55, 59, 101, 105, 143, 157, 167, 168, 177, 179, 180, 194, 205, 223, 224, 225, 226, 236, 237.
Products, 98, 99, 103, 150, 152, 161, 162, 167.
Project, 107.
Proportion, 40, 41, 42, 43, 44, 99.

R

Rama, 81, 83, 95.
Ramayana, 81, 83, 95.
Rational Numbers, 118.
Ratios, 49, 230.
Reconstruction, 19.
Rectangular, 154.
Religion, 224.
Research, 1, 2, 19, 20, 35, 58, 59, 60, 61, 62, 83, 100, 101, 102, 107, 112, 129, 130, 181, 184, 237, 238.
Retention, 116.
Revolution, 187, 228.
Rigveda, 33, 76, 80, 104.
Roman System, 233.

S

Samhita, 61, 62, 74, 75, 76, 89.
Sanskrit, 19, 21, 22, 27, 32, 54, 129, 132, 143, 170, 177, 183, 194, 226, 232, 237.
Scholars, 19, 20, 35, 65, 83, 101, 110, 129, 130, 194, 230, 237.
Science, 31, 57, 59, 61, 74, 75, 76, 87, 88, 90, 93, 94, 100, 101, 105, 106, 164, 169, 170, 178, 181, 184, 185, 186, 194, 195, 209, 224, 242.
Scriptures, 54, 58, 61, 65, 74, 75, 90, 95, 100.
Secretary, 181.

Shiva, 28, 87, 88, 89, 90, 94.
Society, 38, 170, 184, 185, 186, 228.
Solutions, 50, 97, 100, 233.
Space, 36, 37, 41, 45, 59, 62, 63, 64, 70, 73, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 94, 95, 148, 174, 186, 205, 225.
Square, 1, 4, 5, 14, 22, 23, 24, 36, 37, 38, 39, 40, 47, 51, 52, 55, 72, 73, 77, 78, 79, 85, 86, 103, 125, 128, 129, 136, 146, 155, 157, 158, 159, 160, 164, 172, 173, 175, 194, 195, 225, 226, 237.
Statements, 88, 100.
Structure, 2, 33, 39, 44, 45, 47, 49, 58, 59, 61, 171, 238.
Subtracting, 16, 209, 234.
Subtraction, 3, 11, 12, 21, 51, 103, 114, 126, 127, 133, 137, 139, 144, 151, 165, 224, 239.
Sums, 1, 26, 36, 37, 50, 102, 164, 177, 237, 239.
Surplus, 5, 136, 158, 159.
Sutras, 1, 2, 18, 19, 21, 22, 23, 24, 30, 32, 34, 35, 54, 55, 57, 58, 60, 64, 65, 73, 97, 100, 101, 102, 103, 110, 111, 112, 125, 129, 130, 131, 140, 143, 144, 161, 163, 165, 166, 167, 168, 170, 171, 173, 175, 177, 179, 195, 223, 224, 225, 229, 237, 238.
Symbols, 30, 36, 39, 40, 43, 47, 49, 78, 79, 152.
Systems, 75, 105, 120, 179, 223, 233, 241.

T

Technology, 22, 32, 45, 47, 59, 61, 74, 75, 76, 87, 90, 93, 100, 171, 181, 184, 185, 186, 226.
Temperature, 231.
Theory, 186, 188.
Time, 27, 28, 30, 31, 34, 37, 39, 47, 49, 51, 53, 54, 55, 65, 73, 75, 85, 86, 95, 99, 101, 102, 104, 105, 106, 143, 148, 169, 170, 173, 174, 179, 187, 188, 203, 206, 216, 217, 222, 224, 226, 228, 232, 234, 235, 236, 240.
Tradition, 76, 80, 129, 170.
Trigonometry, 2, 53, 54, 55, 102, 143, 188, 225.

U

Universe, 21, 36, 39, 41, 42, 68, 105, 106, 131, 165, 171.
University, 58, 83, 165, 179.
Upanishads, 28, 74, 82.
Urdhva Tiryagbhyam, 152.

V

Vashishth, 104.
Ved Vyas, 74.
Vedangas, 100, 101, 104, 106.
Vedas, 18, 19, 27, 34, 35, 43, 54, 61, 100, 101, 102, 104, 107, 110, 111, 129, 131, 140, 143, 165, 172, 179, 180, 182, 188, 195, 224, 236, 237.

Vedic Astrology, 239, 240, 242.
Vedic Economy, 107.
Vedic Literature, 33, 58, 73, 77, 80, 106, 110, 170, 226, 227.
Vedic Mantras, 58, 61.
Vedic Mathematics, 1, 2, 20, 21, 22, 24, 28, 29, 32, 33, 35, 43, 44, 47, 54, 55, 57, 58, 59, 61, 65, 97, 104, 105, 106, 110, 114, 115, 118, 120, 126, 138, 139, 140, 141, 171, 172, 173, 174, 175, 176, 177, 178, 179, 181, 182, 183, 184, 185, 187, 195, 212, 225, 226, 235, 236, 237, 238, 242.
Vedic Maths, 2, 20, 24, 54, 102, 112, 172, 175, 195.
Vedic Method, 1, 11, 114, 115, 116, 117, 167, 189, 237.
Vedic Numerical Code, 27.
Vedic Period, 106.
Vedic Philosophy, 34.
Vedic Sutra, 11.
Vedic System, 1, 2, 19, 20, 54, 55, 102, 130, 237, 238, 239, 240.
Vedic Wisdom, 73, 74, 75, 77.
Velocity, 216.
Vishnu, 62, 80, 81, 83, 91, 94, 95, 105.

W

Wisdom, 73, 74, 75, 77, 166, 224.

Y

Yashoda, 81, 95.

Z

Zeroes, 23, 24, 157, 159, 173, 174, 234.
Zodiac, 239.

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